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Dyeing Paper Fabrics

Utilization of Paper During the War—Exportation of Part-Paper Fabrics from Germany—Various Uses of Paper Yarn—Work of the Japanese—Methods of Spinning Paper Yarns—Tensile Strength Research—Bleaching—Dyeing—Advisability of Greater Effort in Producing Artistic Effects

By FRED. GROVE-PALMER, A.I.C.

PAPER yarns and fabrics are generally dyed with the same classes of coloring matter as are employed by the cotton dyer and, in principle, the methods are the same but owing to the inherent differences between the two sorts of fiber there must of necessity be a modification of the methods of handling.

There does not appear to be any legitimate reason why paper should not be more extensively used as a textile fiber than it is provided that its limitations are fully realized and no attempt is made to claim equality for it under all circumstances with, for instance, cotton. Paper fabrics have their place in the world's economy and that place may well be enlarged, as paper is distinctly useful and can be made more so. Those textile experts who had European connections during the period of the Great War will have come across a number of cases in which efforts were made to utilize paper for the purpose of eking out the short supplies of cotton and woolen yarns that were available, especially in the Central European countries. It was used to quite a large extent for the weaving of fabrics intended to be used for clothing as well as other purposes, and though it met with a certain measure of success because of the lack of better materials, the use of paper did not make much headway in the clothing trade of the Allied powers. Certainly, paper suitings and dress materials did not appeal to the taste of our own people nor did they, so far as inquiries have gone, make a favorable impression upon the English and the French.

The Germans and Austrians, on the other hand, were not so squeamish, probably forced by the needs of the time, and large quantities of brown kraft paper were used for spinning yarns to be woven into fabrics of the lower grades while those of better quality were made up from yarns that were spun from a variety of white papers. The manufacture of these yarns still goes on even though the need for such low grade fabrics is no longer as pressing as it was during that period.

The spinning of paper yarn was not a war-time invention; it is, in fact, a very old established industry, and it is interesting to find that in spite of the impetus given to the trade by the needs of the war privations little if any improvements were made in the methods of spinning. Any changes that were made in the nature of betterments of details rather than the introduction of fresh principles.

The effectiveness of the Allies' blockading methods led to a grave shortage of all fibers in Germany and Austria; all the cotton that was obtainable was needed for the manufacture of guncotton for the armies while any woolen yarns that could be got hold of were taken for the supply of uniforms. This led to the utilization of paper as the only possible way of filling in the gaps that were making themselves felt in the matter of clothing the civilian population of both countries. In view of this, we cannot fail to be surprised to find that the methods of spinning the yarn should be the same at the end as they were when the need for them originally arose, and have been almost ever since paper yarns were first made.

It has already been hinted that paper yarns and fabrics have their limitations and if they are expected to be more durable than these limitations allow disappointment will inevitably result. The principal fault of paper when employed in textile fabrics is its lack of tensile cohesion and, in order to combat this very serious fault, a greater part of the American and European paper yarns are spun with a core of some long staple fiber, such as jute or hemp. Con-

sequently the strength of the paper yarn often depends very largely upon the strength of jute core; the more jute there is the stronger is the yarn until the proportion of one fiber to another is such that the yarn is simply jute with a wrapping of paper. At this stage it ceases to be paper yarn at all. As a rule the jute or hemp core consists only of a few fibers to give a slight additional tensile strength; this is quite moderately successful but there still remains the inherent weakness of paper when it is wetted. The efforts to overcome this that were evolved before and during the war were not strikingly successful but since that time, as will be shown presently, better fortune has crowned the research work that has been devoted to this important subject.

In spite, however, of all the faults of fabrics made from this fiber, during the latter half of 1917 and during the whole of 1918 the paper material factories of Germany alone employed something like fifteen thousand workers and used up more than one hundred long tons of papers every day.

The clothing fabric that we had an opportunity of examining was found to consist of forty per cent of paper yarn having a thin core of jute, forty per cent of cotton yarn made of a low staple fiber and twenty per cent of a near-woolen yarn made from a very poor grade of wool waste or shoddy. It was badly dyed but the appearance of the fabric was so poor that probably the most skilful dyer could have made no better job of it. It was very tender when wetted and was generally a most unattractive type of cloth, not in the least like some of the Japanese paper fabrics to which allusion will be made presently.

When the big trade boom started up soon after the end of the war and the prices of textiles among all other commodities all over the world began to soar out of sight, large quantities of paper garments were exported from Germany by various subterranean channels and smuggled into other countries; some one evidently thought that, as people were in the mood to buy something, here was a chance to turn a few more or less honest dollars. Those which came our way consisted of working overalls which, at a distance, resembled brown dungaree. The price was about one-third that of the real article and many suckers jumped at the opportunity—once, but not again. The garments were entirely useless, being worn out in a few hours. It was satisfactory to hear that one merchant was left with thousands of the suits on his hands and eventually burnt them to save storage costs. The material was almost wholly paper, there being only a suggestion of jute in warp alone.

Properly employed paper yarns are very useful and have been woven into fabrics of different kinds since the war as they had for many years before. Always the use to which they are put should be wisely chosen and the yarn which has been found suitable for one purpose should never be put to another without very searching trials being made. Furthermore the utmost importance attaches to the stock from which the yarn is made. The usual run of American and European papers, for instance, are not well adapted for yarn to be used in cloths intended for garments; that would require a far more expensive material which would bring the price up to a figure that could not compete with cotton and shoddy. Even then the notion that one was going down town wrapped in the Sunday supplement would prevent the majority of us from taking to the idea calmly. This would effectually stop these fabrics from being a paying proposition though it may be said that some of the cloths in which a strengthened type of paper yarn is woven two and two alternately with a medium grade worsted yarn have a pleasing appearance and a moderately high durability; they can be dyed in good shades and, prejudice apart, might find a limited market for use in places having a warm but not tropical climate.

Perhaps the greater part of the paper yarns that are produced in the United States goes into twines of various sorts, many of which are colored. Much is made up into a very poor class of rugs and carpetings in which the crudity of the coloring is a fine advertisement of their low grade. There is an opportunity here for the manufacturer to do better things if, instead of making his wares so glaring that folk with normal eyesight cannot live with them, he were to dye them in quieter and more artistic colors; there would then be some chance of opening up a different kind of business among that large class of respectable people to whom the spending of every cent is a matter for due consideration.

Another direction in which large quantities of paper yarn are used is in the manufacture of that leno-like open net material used as the backing for home-made woolen rugs; it is usually described as rug-canvas, but the spaces between the threads are much larger than in the ordinary run of canvases in order to admit of the thickness of the wool. These fabrics are sometimes made of cotton, often of paper and the latter has a surprisingly long life. In one case under personal observation a hearth rug in continual daily use has been down for almost ten years and is only at the present moment beginning to show signs of breaking up in a place where it was understood to have been burnt. Durability of that order should be enough to satisfy the most exacting.

A further and more recent adoption of paper yarns of a special sort has been in the manufacture of garden furniture of a kind resembling basketwork. In this case the threads, for want of a better term, are made of a very tough class of paper wrapped around a core of steel wire, thus combining the resilience of paper with the strength of the metal. The furniture is usually made in the grey (or white) and colored

afterward; cellulose lacquers are used for this purpose as it is essential to have the whole waterproof. In this way it is possible to leave the chairs and tables out in the back yard of a town lot with perfect safety for they will stand up to several summers' exposure without showing much deterioration.

We might be pardoned for considering that the Japanese, a nation which specializes in the production of high-grade papers, would have given much thought to the manufacture of textile fabrics from this fiber; in this we are not disappointed for, though the actual quantity made is rather limited, the quality of it leaves nothing to be desired. It is made in one district only of the Island Empire, a little rube town called Atami, right on the seashore that looks into the eye of the rising sun. This place is justly celebrated for its geysers and hotsprings; it is a health resort and all the hotels have their baths of running hot water from the bowels of the earth and even the laundries are run from the same source of supply. As a sideline the town makes a kind of cloth called "Gimpashi-ori" which means "thin paper woven"; this is celebrated all over the country and there are few of the visitors and tourists who go to that attractive spot either for pleasure or for reasons of health who do not carry away with them a few samples of these excellent paper fabrics.

One of them that was examined on the loom has a closely twisted paper yarn for the warp ends with a filling of very fine cotton; it is a plain weave made on a hand loom and the difference in thickness between the picks and the ends renders the latter almost invisible. Other fabrics are made in the opposite way, that is with a cotton warp and a paper filling, and for softer and more flexible materials the cotton is sometimes much thicker than in the case first described. A plain weave would seem to be universally adopted, perhaps because of mechanical difficulties in the production of twill. It must be confessed that a lack of knowledge of the technicalities in the Japanese language prevent definite information being imparted but the impression gained was that a plain weave was traditional, handed down from father to son, and there was no power, human or divine, that would induce them to alter it.

A great number of objects, both useful and ornamental are manufactured from the different classes of paper cloths; these include cigaret cases which are quite firm and boardy; obis or sashes which are stiff yet soft enough to be tied in a bow, and definitely soft materials that can be, and are, made up into pillow covers. Among other items secured on the visit were two of the last, one of which had been dyed a rich yellow color and printed with a bold design in black; the second had not been dyed but left pure white and bore a print of a dragon in black and yellow. Both of these went into household use and received the normal treatment of such articles of furniture, being laundered with the rest of the "linen" when it became necessary and they lasted for over six years being only then discarded because of inevitable changes in the house decoration schemes which made fresh materials a necessity. The paper fabric itself was not damaged. Again, one may venture to say, paper proved its durability if properly used.

The stock from which the Gimpashi-ori yarn is made is not that ordinarily met with in the paper mill; the raw material is mulberry wood, a by-product of the silk-growing districts. The silkworms are fed upon the leaves of the mulberry and when the season is over the trees are pruned of their bare branches. These prunings are not thrown aside or burnt but are sent to the paper factories to be converted into the toughest type of paper known throughout the world; thus the Japanese utilize the waste from their chief source of commercial prosperity as a raw material supply for another source of income in which they have virtually a world monopoly. These mulberry papers are not only used for making textile fabrics, the thinner grades of paper made from this source are used in the most expensive books and for writing papers. The papers made from rice straw which are more generally used in Japan are good but their strength in no way approaches that of the mulberry.

Owing to its natural whiteness very little bleaching is needed, but it is customary to add a small quantity of some soluble blue color to brighten it up.

The following short descriptions of the methods of spinning paper yarns are not without interest; the raw material is supplied to the spinner in reels of ribbon of various widths and are, by him, cut down to the desired size during the process of rewinding on to bobbins; the width of the cut ribbons being decided with regard to the count of the yarn to be made from it. These bobbins are then set up on the spinning engine by which the ribbon is pulled across the surface of a damping roller of felt which is moistened with some liquid such as glycerine in water or, perhaps, a weak mucilage; often it is a special composition made up with the view of producing some definite effect in the yarn. Passing over the moistened felt the paper is drawn between two vertical polished steel rollers and through a small ring the effect of which is to start the edges of the ribbon curling inward. It then reaches the carrier where it is twisted in the course of its run through a ring spinning horizontally; this completes the curling and the twisting and the yarn is wound on to bobbins. The introduction of a core of hemp or jute is brought about by means of a flyer fitted to the spinning engine; this sends the core forward at the correct pro-

portionate speed for the curling paper ribbon to be wrapped around it.

It was in connection with the moistening of the paper strip that one of the chief difficulties in yarn spinning was encountered; if there happened to be a stoppage of the run of the machine, even for a very brief period, the paper resting on the felt would receive a surplus of the damping fluid and was thereby weakened proportionately to the extra amount of liquid taken up. This practically always led to a breakage with the delay of jointing up again. However, it was eventually found possible to introduce a gadget for automatically taking the ribbon out of contact during such a stoppage and replacing it when motion restarted.

Another form of spinning machine has some advantages over that already described; in this case the reel of cut ribbon is placed in a flat box to which is fitted a lid carrying a small slit. The ribbon protrudes from this opening and is drawn out while the box is spinning horizontally and is, in this way, twisted into yarn which is collected immediately on to bobbins. The insertion of a core of fiber or of wire is a very simple adjustment and a perfectly even moistening effect is attained by soaking the whole box containing the ribbon in a bath of the desired liquid. In some cases the damped felt roller is still retained for this purpose, being placed adjacent to the opening in the lid of the box.

Paper yarns as made in this country and in Europe are in almost every instance treated with some solution for the purpose of increasing the tensile strength; this process usually consists of immersing the yarn in the liquid. If this is done by the spinner and the manufacturer of the fabric desires to bleach and dye the yarn, he will often need to treat it in order to remove the impregnation before he can get the color to go on evenly. It will then be necessary to treat the yarn again with the same or another strengthening fluid. In cases, therefore, in which it is known that the yarn is apt to be dyed, it is preferable to purchase it before this treatment has been applied.

Considerable work has been done in many research laboratories with a view to discovering the best compositions for adding to the tensile strength of paper, especially when it is wetted. Naturally, attention was directed to those liquids which have been found to be most suitable in the waterproofing industry as applied to cotton, rayon and silk. Unfortunately these do not yield very good results though there does not seem to be much reasonable explanation as to why this should be so. The process mentioned below is one which has received support in many directions and certainly seems to be the most effective of the many different processes which have been brought forward from time to time. It is a two-bath process, the first consisting of a mixture of tannin, glue and silicate of soda dissolved in water; the second is a solution of the basic formate of aluminium. The ultimate effect of the treatment is that the tensile strength of dry paper is increased by something around ten per cent, while that of the wetted paper is raised by about thirty per cent.

The first bath calls for some skill in making up as if the compounding is unduly hurried it will be spoilt. One and one-half pounds of glue of good medium grade is set to steep in water overnight and in the morning is dissolved by heating in the same water, ½ oz. of tannic acid is dissolved in a small quantity of warm water in a separate jug, and in a third a solution is made of ½ oz. of sodium silicate in a little water. The brand of silicate used should have a specific gravity of 1.31. These two last solutions are mixed together, adding the silicate to the tannin and stirring well. While this mixture is still warm, it is added slowly to the glue solution which should now be at a temperature of 44°C., stirring thoroughly between each addition in order to avoid any precipitation. A sufficiency of hot water is then added to bring the total bulk up to 2¼ gallons.

The method of application is to steep the yarn in the first bath just described at a temperature of around 44 to 50°C. and then, lifting it and allowing it to drain for a while, plunge it, without rinsing or drying, into the second bath which is used cold and contains sufficient of the basic aluminium formate to give a solution having a specific gravity of 1.04. After that the yarn is dried up.

There is another method which is said to add materially to the tensile strength of paper though the chemical reasons underlying the process have not, so far, been explained. It is applicable to papers that are made especially for use by yarn spinners, the process being carried out while the paper is still in the pulp stage. It consists in making an addition to the pulp of a small quantity of a solution of color lake dissolved in benzene; any of the lakes of the insoluble azo dyestuffs such as Hansa Yellow, Pigment chrome yellow, Autol reds and oranges, Lithol Fast Scarlet, Pigment Reds, Pigment Bordeaux, etc., appears to answer the purpose as they are soluble in the hot hydrocarbon quite readily. It is necessary, of course, to use only the smallest quantity in order to avoid tinting the pulp, but even such traces have been shown to be enough to make the resultant paper much less susceptible to the weakening usually sustained by exposure to moisture and to dilute acids.

Bleaching

If it is found to be necessary to bleach paper yarns or fabrics, the method to be adopted follows the lines for cotton, but it must be mentioned that it is not so simple a matter, and there will require to be modifications of the process according to the

origin of the paper. The bleaching of yarns made from sulphate cellulose or soda pulp is considerably more difficult than that of yarns made from sulphite pulp. The method named below is suitable only for yarns that are to be dyed in bright pale colors:

The yarn may be soaked in warm water first if it does not wet out easily, but if this is not necessary it can go straight into a bath of clear, cold "Chloride of Lime" of from 0.7 to 1.0° Tw.; lifted from this it is given a wash in cold water and passed into a cold souring bath containing hydrochloric acid of 0.3° Tw., after which it is well washed.

If, on the other hand, the yarn is to be presented in a pure white condition a somewhat more energetic treatment will be called for.

The yarn is first of all soaked for a couple of hours in a lukewarm alkali bath containing from 5 to 8 oz. of caustic soda lye of 75° Tw., or alternatively, 5 to 8 oz. of dry sodium carbonate per 12 gallons of water. On lifting from this and washing as before, it goes quickly into and out of the chloring bath which consists of a cold solution of chloride of lime stronger than that mentioned above, namely, 1½ to 3° Tw. It is then soured in hydrochloric acid of 0.3 to 0.5° Tw. and after that very thoroughly washed. It will often be found necessary to run the yarn through both the chloring and souring bath a second time to get a pure white, and even then the appearance is cleared and brightened by a final bluing up with a small quantity of Alizarine Cyanole, Water Blue, Pure Soluble Blue or something similar.

Dyeing

Paper yarns and fabrics can generally be dyed with the same coloring matters and by essentially the same process as are employed in dyeing cotton, but owing to the tenderness of wet paper fabrics the details of the handling both in the dye becks and in the bleach vats should be suitably altered. In addition to using the substantive and the basic colors, it is possible to dye paper with the acid dyestuffs, a process sometimes adopted for cross-dyeing when dyed cotton yarn has been woven into the fabric. Paper cloths may not be dyed, or bleached, in rope form as this will produce cracks that cannot be gotten rid of; they must, therefore, be treated fully open and free from stresses in every direction. It is also advisable when dyeing with the substantive coloring matters on paper yarn that is not heavily twisted to keep the alkalinity down to the minimum necessary for leveling up to the color; loose paper yarn is apt to become friable if subjected to long exposure to alkalis.

Some authorities recommend that soda be added to the water to soften it, but this is considered to be inadvisable for the above reason; it is far better to use water softened by a zeolite or in a similar manner. Better leveling of color is obtained when from 5 to 10 per cent of Glauber's or common salt is put in, the quantity used being a factor of the depth of the color desired. The dyestuff is dissolved in near-boiling water and very carefully sieved free from specks of solid matter which would produce stains; the dye solution is added to the bath in small parts allowing the fabric to exhaust before adding the next lot; this will prevent the color rushing on and producing irregularities. Pale and medium shades can usually be worked in a cold or lukewarm bath, but the time of dyeing is shortened if the temperature of the liquor is raised to between 44 and 55° C. Of the substantive dyestuffs suitable for this purpose there are many, but when possible it is advisable to pick out those which have been prepared especially for this fiber. In the following lists will be found a selection of these, but there are many more mention of which is omitted:

Brilliant Paper Yellow, conc.
Chrysoidine GN
Orange 11, conc.
Brown D3GN
Fast Scarlet 8BS
Methyl Violet NE
Paper Blue R, conc.
Soluble Blue R.
Pontacyl Green B.
Nigrozine WSH
Titan Yellow G.
Chlorazol Fast Yell. R.
Paper Fast Orange R.
Paper Fast Brown RK
Chlorazol Fast Red FG.
Chlorazol Violet N
Chlorazol Blue 2R
Paper Fast Blue 2BN
Paper Green BN
Chlorazol Black BH
Thiazol Yellow G
Sun Yellow 2R
Pyrazole Orange G
Trisulphon Brown 2G
Chloramine Red B
Trisulphon Violet B
Chloramine Blue 3G
Chloramine Sky B1FF
Direct Green B.
Chloramine Black EXR.

The fastness to light of many of the colors mentioned above can be increased by treating after dyeing with copper sulphate in the normal way, always remembering that the shade will be dulled by so doing. The brightness of any of the substantive colors may be enhanced by topping off with the basic colors, several of which are named in the lists given here. The dyeing is done in a lukewarm bath

to which a small quantity of acetic or formic acid has been added; there is no call here for the ordinary mordanting with tannic acid and antimony.

The directions for the dyeing process are as for cotton with the modification already alluded to. In the case of the acid dyestuffs, however, the position is rather different for though they are very easily soluble and are faster to light than those already mentioned, it is a fact that they have little or no real affinity for the cellulose fiber. It is therefore easier to get acid dyes to take on paper when it is in the pulp stage. But it is not impossible to get them on the yarns if they are treated with the dye solutions in the present of rosin size and aluminium sulphate. Opinions among experts differ as to whether the latter should be in great or slight excess, but the majority favor an excess of the aluminium salt of 2:1. There are a great many acid dyes that may be used on paper but they are not all equally suitable for paper yarns; among the latter will be found those listed below:

Quinoline Yellow
Acid Orange G
Acid Brown R
Croceine Scarlet 3B
Paper Blue 3M
Disulphine Blue A
Coomassie Blue Black
Xylene Light Yellow R
Orange LL
Paper Brown O3R
Brilliant Sulphon Red B
Sulphonine Blue R
Xylene Fast Green B
Acid Black AT.

The vats, mineral and sulphur colors may also be used as occasion arises; some of them give rather full results which can often be topped off with colors though their well known lack of fastness to light does not recommend their use in a number of cases.

The printing of patterns on paper fabrics does not present any undue difficulty though so far as personal experience goes it is done mainly with hand blocks which, like machine-printing, follows the same lines as are in vogue in the cotton mill print-room. The paper cloth is stretched upon long tables the tops of which are felted to give a soft but resilient bedding, the surface of the felt being covered in some instances with oilcloth and in others with grey cotton fabric that can be washed when required. The thickening of the printing compositions are those generally employed, the greatest favorite being British gum because it is not expensive and can be used easily in mixtures containing chrome mordant colors. Steaming is done in box or cot as usual; the only point being that the operators must never be allowed to forget that the wet fabric will not stand any rough house work.

When vat colors are used for printing paper it is useful to know that the originators of the Hydron dyestuffs have patented a simplified method of producing excellent effects with those colors. The formula given is:

	Parts
Hydron Color Paste.....	60-180
Glycerine	30- 50
Water	65
Gum water, 1:1	450-370
Zinc dust, best quality,.....	250

The above is thorough mixed together by grinding in a paint mill, then the following ingredient is added:

	Parts
Potassium sulphite, 90° Tw.....	175-200

When the material has been printed with this and then dried, it is exposed to the action of moist steam in the cottage for about an hour. The usual practice is to assist the fixation of the pattern by the application of a medium pressure but it is expressly stated, in this case, that it is not really necessary though it does no harm. The cloth is then washed free from excess of dyepaste, after-chroming follows, and next a few runs through a hot soap liquor to impart the required softness. When the goods have been rinsed from the soap, they can be dried up and passed out of the department.

It is a point worth remembering when milling paper fabrics generally that the temperature should not be allowed to rise above 55° C. In some of the instructions issued one finds a sentence such as the following: "Work in a boiling hot bath with about 8 oz. of caustic soda lye of 75° Tw." Personal opinion is that this treatment is far too stringent for the majority of paper yarns; it would cause them to open up and would result in a grave loss of tensile strength which we can ill afford. Even when adhering strictly to the lines here laid down it will be found that some paper will open up to a small extent and become porous. A note as to how to deal with this phase will not be out of place and will be found immediately following the section on cleansing paper fabrics.

No matter how carefully the dyeing of paper goods has been carried out there is very often a tendency towards harshness of handle which can be best overcome by using the soap bath. The soap should be of high grade and made from a neutral oil stock; it may be rendered slightly alkaline by the addition of a trace of dry sodium carbonate or, better still, a small quantity of sodium bicarbonate. Goods may be rinsed after the shaping though some workers prefer to omit this final wash and run the material right on to the calender.

The cleaning and renovating of paper fabrics that have begun to show signs of use demands some forethought and gentleness in manipulation, otherwise there is little trouble

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The American Association of Textile Chemists and Colorists

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QUARTERLY MEETING OF PIEDMONT SECTION

King Cotton Hotel—Greensboro, N. C. January 25, 1930.

MEETING called to order at King Cotton Hotel, Greensboro, N. C., January 25, 1930, R. M. Mitchell, of Greensboro, presiding; Arthur R. Thompson, Jr., of Charlotte, secretary.

Mr. Mitchell: We are going to have a short business meeting, which will not take a great deal of time. First, I would like to welcome all of you to Greensboro. I hope you will have such a good time you will be more than repaid for coming, and that you will come again next year; also, that you will all come to the meeting in Greenville in April. I want to congratulate you on the excellent attendance. The secretary and I have figured that it is the largest meeting we have ever held. But I would like to impress upon you the importance of sending us your acceptance. Last January at the Greensboro meeting we had 35 acceptances, and about 150 came. Probably some of you remember the embarrassing position we were in. This year we had over 140 reservations, and over 200 are here. But we have been able to handle the matter all right.

I also want to take this opportunity to thank you for the honor which was given me at the annual meeting at Charlotte. I value the honor highly, but I do not underestimate the responsibility of helping you men carry forward this section at the same rate of progress you have made in the past years.

In going over with the secretary and the other officers the layout of work for the coming year, there were several objectives which we desire be kept in mind, and which I will sketch very briefly.

First, increased membership; second, continuation of interest and participation in the discussion of the papers which will be delivered before you this year; third, the formation of a junior section at State College, Raleigh, Professor Nelson and Professor Grimshaw are both interested in this matter and we should give them all the backing we can; fourth is a matter which has been brought to my attention by several members. It has to do with the idea of getting more representation on the Association Council. Increased prestige and representation will insure a larger and more active membership, and when the time comes, which will be in the near future, I trust this Section will be granted the added recognition.

We start off the year with 112 paid members. For some reason we were carrying 169 members on the mailing list. This was a serious discrepancy and it disturbed a little to find why it was that we were mailing notices to so many who were not credited by

the Association in New York as being members. We found there were 10 or 12 men who had let their membership lapse without resigning. We hope to get them back into the organization. The secretary has plenty of blanks and we hope any here to-night who have not paid will sign up, because in fairness to those who are paying their dues we ought to have a full paid membership. You understand out of the five dollars which you pay as dues, one dollar per member comes back to the organization in the Piedmont Section as a sinking fund against emergency, and also to help pay for the annual outing, which will probably be held in Charlotte.

There are many here eligible to membership. Out of the 200 at the meeting to-night about half are paid members. It would add wonderfully to the interest of the Section if every paid member would take it upon himself to secure an application before the April meeting.

We have with us to-night the members of the Textile Chemistry class from State College, who were brought here by Professor Nelson and Professor Grimshaw. We would like to have them stand. (Applause). I hope they will come to recognize the value of membership, also the value of acquaintanceship and friendship with the active members now engaged in textile work, because they are soon going to graduate and will be looking for jobs in this section.

I believe the secretary has a few words to say before we go on with the meeting.

Mr. Thompson: I believe Mr. Mitchell has covered the points I want to bring up. One thing I wanted to say and to emphasize is that if you have changed your address and have not received notice of this meeting, I hope you will let me know your new address so I can be sure and have the programs sent you for the rest of the meetings to be held this year. I have a few returned envelopes, and fear some of the others were not received.

The chairman also mentioned that some of the membership have lapsed because of non-payment of dues. I know most of you have simply overlooked this, but the secretary of the Association has instructed me to take from the mailing list the names of all who are not in good standing, so if there is any one here tonight who would like to have an application blank, either for reinstatement or for junior membership for those under 26 years of age, or associate membership for those not actually engaged in the textile industry, we have the application blanks here. Salesmen and those not actually engaged in the plant are eligible only for associate membership.

There has been a suggestion made to the secretary that we institute a question box for each meeting. In other words, if you have any questions to ask, you will present them either to the chairman or secretary, or send them by mail. It is not necessary that your name be divulged, but it is necessary that you sign the questions you send in.

Suitable time will be allowed at the meeting for answering and discussing the questions sent in. Quite often the paper or papers presented at the meeting are not interesting to everyone. With the varied elements represented we cannot hope to interest everybody here, but if you have some problem that is not touched upon at the meeting, you are invited to send it to the chairman or secretary, or present it orally during the time allotted. The same procedure will be followed at the next few meetings, if it meets with your approval.

The chairman announced that the next meeting would be in Greenville in April. When the notices are sent you, with a stamped envelope for your use, please just sign your name, stating whether you will be here, drop it in the mail, and I assure you we will very much appreciate it.

Mr. Mitchell: That ends the business, and we will now hear from Mr. Sandridge, who has provided some entertainment for us, which I am sure will be very pleasing.

Mr. Sandridge: When our chairman called on Mr. Glenn and myself to plan our entertainment program, I found Bob one of the most agreeable committeemen I ever worked with. He said to me, "Jim, just go ahead and plan anything you want, and I will O. K. it." So I want to thank him for being so pleasant to work with.

I do not believe any town has better local talent than Greensboro. We did not have to call on any one outside.

First I want to introduce Frank Warner, who has charge of the boys' work at the Y.M.C.A.

Then we have a company of men in Greensboro known as the Carolina Legionnaires, from the local Henry K. Burtner Post. I want to introduce Fred Phipps, Aubrey Smith, Ralph Hodgkin, and Paul Gyles, with Miss Sue Kyle Southwick, accompanist. I understand the baritone of the group is out of the city, so that they cannot do any collective singing.

I want also to introduce Mrs. Dewey Farrell, who has been good enough to come and sing for us.

A most enjoyable and pleasing program of music, monologue and readings was then given and enthusiastically received.

Mr. Mitchell: We have enjoyed this program very much, and Mr. Sandridge tells me that Mrs. Farrell will give a solo number later.

As I said earlier, the first pleasant surprise was when I saw the large number here to-night. The second pleasant surprise was when I met an old and

close friend of the speaker. He has consented to introduce the first speaker of the evening, and I take pleasure in introducing to you now the Treasurer of the Jefferson Standard Life Insurance Company, Charles W. Gold.

Charles W. Gold: Mr. Chairman, ladies and gentlemen: Were it not for the fact that I am such an admirer of this gentleman I am to present, I would wonder why I, a life insurance man, was selected to talk to dye-ing men. As a life insurance man I am not interested in "die-ing" men, but in living men. (Laughter).

Your President said I would introduce the speaker. I do not like that word "introduce." Every man in the vicinity of North Carolina should know him well. I do want to present him to you as a grand jury. He is guilty of high crimes and misdemeanors against ignorance and prejudice in educational methods in North Carolina. Years ago he became Superintendent of Public Instruction in North Carolina, and the wonderful work he did will make his name go down in history as one of the men who has made our public school system the acknowledge standard for school systems of the country.

About seven years ago it was my privilege to help elect him President of North Carolina State College of Agriculture and Engineering and, gentlemen, I would have you know that that institution has more than doubled in size, in equipment and in worth-while work since he has been in charge of its affairs.

He is very much interested in the things for which you stand, and his genius for organization has made itself felt not only in that institution but in the State of North Carolina.

He has recently been placed at the head of the commission for the study of county government and this, in my opinion, is one of the most important things that North Carolinans have to deal with. He and his commission have laid the groundwork for some excellent improvement along that line and these are things in which we are all interested.

Gentlemen, I take pleasure in presenting to you this gentleman who is guilty of these high crimes and misdemeanors, Dr. E. C. Brooks, President of State College. (Applause).

THE NEED OF BROADENING TEXTILE EDUCATION IN NORTH CAROLINA

By Dr. E. C. Brooks

President, State College, Raleigh, N. C.

Mr. Toastmaster, ladies and gentlemen:

I was requested by your Program Committee to discuss the subject, "What State College is doing for the Textile Industry of this State." That is a task beyond my powers, but with a little help from this audience, I can present such a speech in a very concrete way. Will all the men in this hall who have attended State College, please stand. (Applause). There is nothing, Mr. Toastmaster, for me to add to that, except to follow each one in his work, if I were able, and tell the contribution he is making to the textile business of this State. After having complied with your request, may I now discuss the need of broadening textile education in North Carolina?

Some time ago our Board of Trustees, considering what State College might do further for the textile industry of this and adjoining States, appointed a Textile Committee to study the situation and report on the needs of textile education in North Carolina. It selected on that committee Messrs. S. B. Alexander, David Clark, Arthur Dixon, Maurice Hendricks, and J. A. Long. I feel quite sure these men are known to you all. They meet from time to time, and a little over a week ago we presented to the Chamber of Commerce of Charlotte the tentative conclusion of that body. I was requested by your program committee in discussing what State College is doing for the textile business of this State, to speak somewhat on the findings of that committee.

The Lowell Textile School, a few years ago in stating its purpose in broadening textile education in Massachusetts, said: "The plan was organized during the apparent crisis in the leading industry of New England, due to the rapid development of the manufacture of the course cotton fabrics in the Southern States. It is believed that this crisis could be met only by a wider and more thorough application of the science and arts in the production of finer and more varied fabrics." If this applied to New England then, it applies to North Carolina now, since textile manufacturing has begun to develop far to the south of us.

A survey of textile education in Massachusetts presents some interesting facts. That great State has put the force of that commonwealth behind that industry by supporting these large textile schools. The total enrolment in the day schools for the year just closed was only 391, but the enrolment in the night school—and the night school has its program of studies which leads to graduation—is 2,837. Seven times as many men are trained in the night schools as are trained in the day schools.

But the textile industry has a tendency to move southward and this is affecting the enrolment, both in New England and in the South. In New England the enrolment shows a tendency to decline, while in the South it shows a tendency to increase.

The day school in North Carolina, which is located at State College, compares very favorably with either

of the three schools in Massachusetts, only Lowell having a larger enrolment, and only very slightly larger than that of State College, but we have no provisions in this State for giving special training to men in the industry except that which comes through the State Board of Vocational Education and provides more or less elementary training, elementary so far as the industry is concerned. That is good, but it does not meet the situation. It is very evident that the larger number of skilful technicians come from the night schools. The men in the industry already experienced in the line of their particular specialties are given the larger opportunity in night schools to acquire that skill or that scientific background that makes them desirable specialists in particular fields.

But what are needs in North Carolina?

1. Our first consideration should be to broaden our textile curricula at State College. We now have two general curricula for undergraduates—textile manufacturing and textile chemistry and dyeing. There seems to be a demand for the introduction of new courses and the offering of new curricula. Therefore, the Textile School proposes the following to be inaugurated at the beginning of the next college year:

One curriculum in general textiles is uniform for the first two years, but there are offered three options in the junior and senior years. Emphasis on textile engineering, mill machinery, and mill management; special courses for graduates that desire to become teachers in evening classes; and special emphasis on marketing and salesmanship. But all three options should include yarn manufacturing, cotton and rayon fancy weaving and dyeing, fabric analysis and testing, and the usual studies in history, English, economics, science, and the like.

It is agreed also that special curricula should be provided to place emphasis on yarn manufacturing, weaving and designing, textile chemistry and dyeing, and that a new curriculum should be introduced for seniors and graduates to include fabrics and their uses, domestic and imported fabrics, colors in woven designs, textile designing, fabric analysis, fabric testing, and textile microscopy; and these should form also the background or the basis for practical study of fabrics that they may lead to interior decoration, etc.

A group was sitting in a room and discussing the subject. One of the men said, "Look at that window and at the women present. Within the last ten years women have shown a tendency to wear less and less clothes, while windows are weaving more and more clothes." Then he gave a description of the window, how it is changing to some extent the textile industry of this country. It was also said that interior decoration and the furnishings of the modern home are seriously affecting the textile industry and creating new vocations for women.

2. In the next place, there is need of a broader research program to be sponsored by State College, the State Textile Organizations, Arkwrights Incorporated, The Southern Textile Association, other allied organizations whose businesses depend upon the textile business, and a co-operative relationship with other textile schools of the country, all working co-operatively in order that we may give to the textile industry the most serviceable schools and the best application of the newest sciences to the textile industry of North Carolina.

The greater part of this research should be, of course, conducted in some mill center as a branch research station for the college. Let me give you a parallel to that. We have a School of Agriculture, including a research station, at State College, but it is impossible for us to give all the research work at the institution that is needed for this State. Therefore, in co-operation with the State Department of Agriculture and the Federal Government, we maintain a branch station near Asheville, one near Statesville, one near Oxford, one in the coastal plains near Tarboro, one in the black lands in the northeast section of the State, one in the trucking center near Wilmington. It is an agricultural necessity to maintain branch stations where research may be conducted which will be of benefit to the different sections of the State. We do not have quite the same parallel in the textile industry, but we do have it to this extent—there should be provided one or more textile research centers in the very heart of the mill section of this country to give to the mill interest of the State that science, that skill, and that technique which it needs for diversification in order that we may move away from the coarser fabrics now manufactured south of us and rival the best manufacturers in this or any other country, for we have the native stock that can be taught, but we have not provided the technique nor the science that will give them the opportunity.

The purpose should be to secure information on all subjects that will be of value to the textile business, to encourage the research now done at the college and conduct much of it in the mills under supervision, to co-operate with the agencies mentioned as far as possible, and further the research in one or more mill centers, to provide opportunity for the training of experts, and finally to disseminate knowledge of value to the mills of this State.

You may be surprised to know that at State College, under the direction of Dean Thomas Nelson, we are carrying on quite a number of tests for the mills. I will not undertake to mention all, but the requests coming from mills to Dean Nelson are to-day far greater than our faculty can meet. Some of the results have already been published and furnished to the industry. The faculty has some under consideration now and some of them cannot be completed as quickly as desired, because of the teaching load carried by the faculty of the Textile School. The need for much greater research is already apparent.

3. The third need is to broaden the courses for seniors and graduate students, to provide study of special operations in the mills under normal or natural conditions. This likewise is in line with what we are doing in other schools of State College. For example, in the School of Education, which trains teachers for our agricultural high school, the seniors leave the institution during one term's work. In like manner we could arrange for seniors and graduate students of the Textile School to work in those mill centers, where research is conducted and devote one or two terms in pursuing special work under natural conditions.

4. The fourth need is to provide evening classes for mill operatives. It appears that the supply of trained men in New England and the large number of them that come here to the textile industry of the South are products of the night schools. There is a demand for such instruction in North Carolina. It will be necessary to inaugurate it in a center or centers where it will be accessible to the largest number of workers in the mills. Such night schools have a tendency to increase the earning capacity of mill workers, which is a decided factor, of course, but better than that, it offers to worthy young men, who are married, perhaps, and who are unable to leave the mill and enter a day school, the opportunity to take the necessary training. The directions of these men are already determined and the more capable ones would welcome an opportunity to equip themselves in special fields.

In New England, as I said before, 3,228 students are enrolled in the three textile schools. In North Carolina 155 are enrolled in one textile school. The chief difference is to be found in the night schools of New England, where 2,837 are enrolled, and by far the greater number of specially trained men are the products of the night schools.

The night schools properly located and supported in North Carolina would give our native population an equal chance with the mill workers of New England, and it is the belief of the Textile Committee that we should give such a chance to our native population, who are capable of reaching just as high a stage of skill as are the workers in any textile center elsewhere.

5. The fifth need is to provide at least one contact man, perhaps two, to aid in organizing and conducting research, in supervising work of seniors and graduate students in mill centers, and in planning evening classes. Of course, one man cannot direct all these enterprises when they become a reality. But one man can devote whole time, working under the Dean of the Textile School, and in co-operation with textile organizations, textile manufacturing, and allied industries, he will soon make these needed educational enterprises a very serviceable reality.

The Textile Committee of the Board of Trustees of State College believes that there are some of the needs that we should undertake to meet at the opening of the next college year and that they should be worked out in such a way that the new work planned in mill centers shall not duplicate or diminish, but shall strengthen, the work now conducted at State College. It believes also that the first step is to employ the contact man referred to a moment ago, and gradually broaden the work to meet industry's needs. What they may be three, five or ten years from now will depend in a large measure upon the change that takes place in the textile industry. (Applause)

R. M. Mitchell: For the Piedmont Section, I would like to express thanks to Dr. Brooks for coming here and giving us such a wonderful contribution. (Applause)

Mr. Sandridge: As some of the musicians are compelled to leave, before we proceed with the program I want to take this opportunity to thank all our entertainers for the splendid program they gave us, and for the very fine co-operation they gave me in getting up this program. It has been a pleasure to listen to it. (Applause)

R. M. Mitchell: The last paper of the evening is entitled "The Standardization of Chemical Processes in the Dyestuffs Industry." The man who is going to make this talk is in the Research Department of the Dupont Company at Wilmington and he has had vast experience in his line.

I would like to introduce to you Oakley M. Bishop, of the Research Department of the Dupont Company.

THE STANDARDIZATION OF CHEMICAL PROCESSES IN THE DYESTUFFS INDUSTRY

By Oakley M. Bishop and John H. Sachs

The Dupont Company

We meet to-night on the common ground of an interest in chemical processes. We are engaged in the transformation by means of chemical action of less valuable into more valuable materials for the trade. The degree of efficiency which we can attain in the chemical processes which we employ will determine largely our success or failure in our respective industries. While I shall speak to you from

the viewpoint of the manufacturing chemist, I believe you will find that the same principles and methods which we use in the standardization, or, if you please, the chemical control of chemical processes in the manufacture of dyestuffs can be applied with like success to your problems of application. As you follow me you can best be the judge of this.

When the term standardization is used in connection with the dyestuffs industry, one naturally thinks of the maintenance of uniform standards of strength and quality in the finished dyestuffs produced. We wish to go deeper than this into the matter and to show that this adherence to clearly defined standards must begin with the initial manufacture and must be applied at every stage of the process in order to insure successful results. This can be accomplished only by the proper application of suitable physical and chemical tests to the materials used in the action, to sample portions of the charge during the action, wherever this is feasible, and to the final product, or products, of the action. Viewed in this light, no chemical process intended for use in manufacture can be regarded as complete that does not contain (1) definite physical and chemical specifications for the materials to be used in the charge; (2) control tests which have been developed to indicate the course of the reaction, its progress and completion, and (3) tests to show the value of the final product for the use for which it is intended. We propose to discuss the subject under the three heads mentioned.

I—Tests on the Materials Used

For the purpose of this discussion we are assuming that the chemist engaged in the development of a chemical process to be used in manufacture has selected the most suitable materials for producing the desired result, that he has determined the proportion in which these materials are to be used, and that he has established the usual factors of time, temperature, etc., most favorable for the action. If his work has been properly conducted he has established goal yields and results with the use of the purest materials obtainable, and to do this it is often necessary to resort to extreme methods of purification which might prove uneconomical for large scale production where the item of cost is of so much importance. His problem is then to test for use by comparison the best grade of technical product which can be purchased or, if, as is so often the case in the manufacture of dyestuffs, the intermediate or chemical desired is not a regular article of trade, he must determine how this can be produced on a large scale with the highest standard of quality consistent with reasonable costs. We may say that in the field of anthraquinone intermediates and dyes with which we are most familiar so much progress has been made in this direction that the majority of the intermediates used approach a degree of purity which is commonly designated as chemically pure.

When we consider the way in which chemical action takes place, it seems hardly necessary to emphasize the importance of using pure materials in order to produce therefrom pure chemical compounds. While numerous examples might be cited from the synthesis of the dyes themselves, I am giving to use as an example the simple nitration of benzene where two products enter into an action, termed nitration, with the formation of two compounds, nitrobenzene and water. Suppose now that the nitrobenzene contains five per cent of toluene. Three materials then enter into the action and there are three products of the action, namely, nitrobenzene, nitrotoluene, and water. Suppose again that the nitrobenzene contains five per cent of toluene and five per cent of xylene. There are not four materials going into the action and four products of the action.

From a consideration of the above it obviously follows that the easiest way of preparing pure nitrobenzene consists in the nitration of pure benzene. But even with pure benzene the problem of obtaining pure mono-nitrobenzene is not as simple as it seems, for under certain conditions the nitration may proceed beyond the mono stage and dinitrobenzene may be formed. Therefore, in order to obtain the highest yield of the purest nitrobenzene with the least effort of purification of his product, the chemist will determine first of all that he has pure benzene and will then find by experimentation the condition under which the least amount of dinitrobenzene is formed.

Perhaps I can bring the point closer home by citing a case from our own experience in the manufacture of colors. When we first started laboratory work on the preparation of vat colors at one of the Dupont laboratories in the year 1917, one of the first experiments conducted was the sulphonation of anthraquinone to produce anthraquinone-beta-mono-sodium sulphonate which, because of its bright, silvery appearance, is called "Silver Salt." We had about a kilo of Merck's anthraquinone of very fine quality and from this we obtained silver salt of excellent quality with a yield of 80 per cent of theory. This is converted to beta-amino-anthraquinone and the betamine was fused to yield Indanthrene Blue which, even with our inexperience, was at least blue. But the bottle of pure anthraquinone was soon empty; it was war-time and no more was to be had. We were forced to produce our own anthraquinone from crude anthracene, which is a foul mixture of anthracene, phenanthrene, carbazol, dead oils, and many other things. Only those who have tried this job know of its difficulties. I can tell you that it was many months before we produced in our manufacture a really high grade of anthraquinone, and if there are present any who used, or tried to use, the domestic vat colors in

the early days of their manufacture you may be sure that this was at least one of the reasons for their poor quality.

During the past several years practically all of the anthraquinone used in this country in the manufacture of vat colors has been produced synthetically from phthalic anhydride and all that which we have tested has been of an exceptionally fine quality.

I cannot leave this subject of the testing materials without at least a brief reference to that important class of substances termed catalysts which in very small amounts exert a powerful influence upon the rate or the course of certain chemical reactions. When rightly used, and if their presence is known and their action understood, they are one of the greatest aids of the chemist. Examples of this are the use of iodine to accelerate chlorinations, the use of copper salts to facilitate many of our condensations, and the use of mercury salts to orient the sulphonic acid group in the anthraquinone molecule to the 1-position. Sometimes, however, traces of impurities, the presence of which is unknown or which are present in such small amount as to have been reported by the analytical chemist as a "trace," may exert this catalytic action in an adverse manner so as to greatly retard or almost entirely inhibit the reaction or misdirect its course. Problems of this character are among the most difficult met with in chemical control and sometimes baffle the skill and exhaust the patience of the most experienced chemist over a long period of time. I will mention two examples from my own experience. One involved the transfer of a very simple operation from a wooden to a tile-lined tank in order to reduce replacement costs on the equipment. In the wooden tank the operation had offered no chemical difficulties, giving excellent yields and completing itself in a period of a few hours. Our first charge in the tile-lined tank was a long way from completion at the end of five days. Investigation finally showed that the presence of traces of a certain metal in the cement used for pointing up the tiled tank was inhibiting the reaction. In another case the presence of less than one-tenth of one per cent of an impurity in a raw material which was regularly obtained with a purity of 99.5 per cent or better caused a drop of 40 per cent in the yield of the desired product.

II—Tests During the Action

Not only in the adaptation of a chemical process to large scale manufacture but during the entire time of its operation it is essential that the chemist or someone trained to act in his stead keep informed of the progress of the action and determine whether or not it is proceeding in the desired manner. This is done by the application of tests which are commonly designated as "chemical control" tests. Examples of these are (1) spot tests used in the coupling of intermediates to azo colors, whereby an excess of deficiency or a particular intermediate can be determined; (2) nitrogen or chlorine determinations to determine the degree of nitration or chlorination; (3) solubility tests to determine the degree of sulphonation, and (4) microscopic tests which can be used in many cases to determine the extent of the transformation of one crystalline compound to another.

We know of no other means whereby the hazards inherent in the majority of chemical operations can be so effectively reduced as by a consistent and careful practice of chemical control. Especially is this true in the dyestuffs industry where many of the chemical operations carried out are of a complicated nature, where many of the materials used are costly, and where such high standards are required in respect to the quality of the products produced. To depend for control only upon the usual physical factors of time, temperature, etc., can be regarded in no other way than as foolish. Not only is it essential in maintaining an operation on an even keel but observations made in the course of this test work not infrequently lead to higher yields and quality or to a simplification of the procedure, resulting in lower operating costs. By this means the chemist not only knows the progress of the desired action but discovers the undesirable side reactions which are usually present leading to impurities and a reduction in yield. In many cases he is thus able to eliminate these wholly or in part. As an example of the importance of chemical control and its application to practice, we cite the manufacture of 1-chlor-2-methyl-anthraquinone by the chlorination of 2-methyl-anthraquinone. Under proper conditions properly controlled the major portion of the chlorine introduced enters the 1-position of the anthraquinone molecule, resulting in the formation of the desired 1-chlor-2-methyl-anthraquinone. The presence of certain foreign substances as impurities, however, may cause a considerable percentage of the chlorine to enter the side chain, that is, to be substituted in the methyl group. Furthermore, if the chlorination is not stopped at exactly the proper time chlorine will continue to enter the anthraquinone molecule, resulting in the formation of di- or poly-chlor-anthraquinones. Now the presence of chlorine in any position other than the 1-position of the anthraquinone molecule greatly impairs the value of this intermediate for use in the synthesis of dyes. Therefore it is obvious that no condition or substance must be present which would favor the formation of side chain chlorine and the degree of chlorination must be followed by analyzing samples taken from the charge so that the chlorination can be stopped at exactly the right time.

III—Tests on the Finished Product

We come now to the last and the most important phase of this subject, namely, tests on the finished product. It is, of course, recognized that all of the things which we

have discussed under the first two heads are only means to the great end of producing better and cheaper dyestuffs. The wise builder insists upon good materials properly put together, but his chief concern, after all, is the appearance and the utility of the finished structure. We have called this heading tests on the finished product. But what is the finished product for one industry may be the raw material for another industry and so on until the product finally comes into the hands of the ultimate consumers. Our finished colors are one of your chief raw materials. Our success in manufacture must be judged by the use to which you can put our colors and the results which you can obtain from them. We come then to the point that it is of extreme importance that the manufacturer know the use to which this product will be put. We are convinced that a lack of knowledge and co-operation on this point is one of the chief causes of misunderstanding between the manufacturer and the user of dyestuffs. Where there is a clear understanding between the producer and consumer as to what is required of a product, there is little chance for trouble unless one or both should be careless or dishonest.

The diverse chemical nature of the substances used as dyestuffs, the various methods by which they are applied, and the different procedures obtaining in the methods of application at the different mills, all serve to emphasize the need for this co-operation. An example of different uses for the same class of colors is the vat color pastes. These pastes may be applied by (1) the dyeing of raw stock; (2) the dyeing of yarn on the beam or in the Franklin Machine; (3) the dyeing in the reduced state in the jig; (4) the dyeing by the pad and jig method, and (5) they may be printed. A paste may work entirely satisfactorily for one or more of these methods but may be unsuited for another of these methods. Narrowing the proposition down to a single use, the important one of printing, the problem of producing the best type of paste for printing is one that is engaging the best brains of the research organizations engaged in the manufacture of these color pastes. Certain things we know. These pastes for printing must be homogeneous and must not settle. They must admix readily with the printing gum without coagulation to produce a printing paste which is of the right physical consistency and which will flow readily into the depressions of the roller. They must be free of grit to prevent scratching of the roller and a consequent formation of an impression upon the printed fabric. Thus far the manufacturer can go, and speaking for the company with which I am associated, in addition to complying with the above tests, you may be sure that every lot of paste intended for use in printing is subjected to practical trial before being sent out to the trade. Strict compliance with all of these things, however, is not a guarantee of satisfactory mill results. A textile mill may have a special printing formula differing from the one by which the product was tested, different ageing conditions may markedly affect the results, or the other chemicals used in the process along with the color paste may contain impurities or be otherwise unsuitable. Besides, numerous unobserved and entirely unpredictable factors often creep into the best controlled technical operations to cause trouble. I recall that a number of years ago a severe drougth in eastern Pennsylvania and the surrounding district caused such an increase in the per cent of salts present in the water of the Delaware river as to seriously affect the manufacture of certain of our colors. Such a condition would probably have had an even more harmful effect on the operations involving the application of these colors. Occasional difficulties are bound to arise, but by careful and regular testing of all materials used, by the full application of physical and chemical control to the operations and by a close co-operation between the manufacturer and the user of dyestuffs we believe that many of the troubles that vex both can be eliminated.

Gentlemen, I am not very close, not nearly so close as I should like to be, to the textile industry. But I am well aware of the marked change that has taken place in this industry during the past ten years. If the old rule of thumb methods of dyeing are not entirely gone, they are at least fast disappearing. And we need only to see the high quality of the work which is being turned out by the better class mills to know that they have learned the tremendous advantage of standardization and chemical control of their operations. To the textile industry is due much of the credit for the better quality of the dyestuffs now in use. Not only have you insisted upon quality but you have demanded that the manufacturer supply you with the colors which you want in a form which will meet your requirements. This the manufacturer is earnestly trying to do. Thus co-operation and chemical control are combining in the production to-day in America of better textiles and better dyestuffs. And the future holds rich stores for those mills which will apply the principles of chemical control and which will co-operate with the manufacturers of the products which they use. (Applause)

Mr. Mitchell: We certainly appreciate Mr. Bishop coming here to give us this most excellent and interesting paper.

Before we adjourn I would like to suggest that in this problem box we want to inaugurate, you send your questions to Mr. Thompson or to me. No names will be mentioned at the meetings, so you may feel perfectly free to bring your problems in that way.

If there is no further business, we will declare the meeting adjourned.

JANUARY MEETING OF THE RHODE ISLAND SECTION

THE January meeting of the Rhode Island Section of the American Association of Textile Chemists and Colorists was held on Friday evening, January 31, 1930, in the rooms of the Providence Engineering Society.

The following officers were re-elected for the year 1930:

Richard B. Earle, *Chairman*
A. Newton Graves, *Secretary*
Ben Verity, *Treasurer*

SECTIONAL COMMITTEE

John G. Masson
Carl R. Moore
Morrell Mackenzie
Herbert F. Schwartz

The Nominating Committee consisted of the following:

John Hutton
Alfred L. Lustig
A. N. Dana

Dr. Earl K. Strachan of Brown University gave a very interesting talk entitled "Some Facts About Colloids."

Thirty-four members were present.

Respectfully submitted,
A. NEWTON GRAVES, *Secretary*.

SOME FACTS ABOUT COLLOIDS

By DR. EARL K. STRACHAN
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I SAID it would be a very elementary talk, not to be an affront to your intelligence, but to express the limit of my own knowledge of the subject. Tonight at dinner my little boy asked where I was going and what I would do. I told him it would be an experimental talk. He said, "Are you going to do like the man we saw who took a dollar bill out of a hat?" When I have an experimental talk I feel as if I had to take a rabbit out of a hat.

The colloidal state of matter is the most important state there is. If we want to flatter ourselves that the human race is the most important thing on earth we can think the colloid is the most important state; otherwise we would be crystals and solids, most of us. What is a colloid? It consists of two different kinds of matter, one of them being very finely subdivided and distributed through the other. Many of you are engaged in preparing colloids —tobacco smoke is a colloid; suds is a colloid. Tobacco is small particles of soot distributed through the air, and suds, fine bubbles distributed through liquid. Soft soap is a colloid. It is suitably subdivided and mixed with water. In each case it is the state of the system that determines whether it is a colloid or not, and not what the system is made up of. It is conceivable that every chemical substance might occur in the colloidal state just as anything can occur in the liquid, solid, or gaseous state. So, too, anything may occur in the colloidal state if sufficiently subdivided—so that you could consider the solid particles of carbon and mineral salts that float away in smoke—by themselves they would be solid salts, but you mix with a finely state of air and you churn it up with water and make it colloidal. When we open the faucet here in Providence we draw off a colloidal system of air. It is a very unstable colloid but while it lasts it is colloidal. Colloidal chemistry is a study of chemistry and physics of a class of systems rather than a kind of substances. It is distinct in that way from the ordinary branches of chemistry such as inorganic chemistry, electric, etc. It is more like biochemistry; it is a study of a kind of systems.

The essential characteristic is a fine subdivision of one of the ingredients. Since you can think of substances existing in any state of subdivision from the coarse particles which you can pick up to the fine precipitates—and further on to the molecules themselves—it becomes an important question to draw a conclusion and say that particles coarser than this are not colloids, and particles finer are true solutions. Of course there is no such demarcation in nature and we have to invent one. The most useful delineation of colloids is based upon the methods of study. We speak of coarse suspensions, and of the colloidal systems, and the true solutions. The degree of subdivision is referred to as the degree of dispersion. The more finely subdivided the more highly dispersed the system is. The true solution is called "molecular dispersion." One of the characteristics of the coarse suspension is that it does not pass a filter, while colloids and the true solutions do pass a filter. The coarse suspensions are microscopically analyzable: if you take a coarse suspension and look at it under a microscope, you can see the individual particles and see their shape. If you look at the other, you see nothing but a clear liquid in general. At any rate, you cannot distinguish the parts microscopically. That distinguishes the coarse suspensions from the colloids, and the true solutions, on the one hand—we must draw a dividing line between them. The colloids do not diffuse. If you take a tall cylinder of water and a drop of copper sulphate, the copper sulphate will dissolve and form a blue color. It will creep up the tube while diffusing. Colloids do not diffuse, while true solutions diffuse. Colloids do not dialyze, while true solutions can be dialyzed. That is, the colloids will not pass through a parchment membrane, while the true solutions will pass through a parchment membrane. These are not hard and fast boundaries. You will find many systems right on the boundary line: in other words, you will find many colloids right on the boundary of being true solutions. It is hard to see which they are. They possess the properties of both. We can say that this subdivision comes at one-tenth of a

micron, it being one one-thousandth of a millimeter from that limit to the next. In general, the true solutions are less than a millimicron in diameter, although some of the larger molecules must be considerably longer than a millionth of a millimeter. Sugar is pretty close to this limit. Stearic acid—some of the dyestuffs right on the ragged edge—under some conditions very colloidal, and others not—so you can't draw a line hard and fast. The degree of dispersion increases in that direction: the finer, the more highly dispersed.

Colloids may be classified in still another way quite differently, as to their state of aggregation in different phases. You can have colloids that consist—as tobacco smoke—of solids suspended in a gas; systems consisting of particles of gas suspended in a liquid, like foam; or particles of solid suspended in a liquid, like muddy water or a solution of some of the dyes, etc. You can make another classification and group things a little bit differently. We can speak of the "continuous" phase and the "disperse" phase. The continuous phase is like the air and smoke question. The real test is, can you pass from one point in the continuous phase to another point without crossing a boundry? If it is a discontinuous phase, you have to pass a boundary. That question of which is the continuous and which discontinuous phase is highly important in certain cases. We have many emulsions of oil and water, some of which the oil is the continuous phase and some of which the water is the continuous phase. The oils you emulsify for textiles. In general, the water is the continuous phase. I will mention that later. Suppose the continuous phase is a gas and we have particles of solid in it—it is smoke. Supposing we have gas for a continuous phase and particles of liquid in it—that is a mixture. The atmosphere in which we live is a colloidal system on some days. Its particles of moisture suspend in the air. Suppose we have a liquid and suspend in that a gas, we have foam. A liquid with another liquid in it, and you get an emulsion, or a gel, depending on largely whether it is a fluid or a solid. You can have a liquid with a solid suspended in it. Here you get a gel again—some gels are solids—or a suspension. Now we have a continuous phase that is a solid, and you can suspend the gas in it. Pumice is an excellent example. Meerschaum is a good example. A solid with a liquid in it—that is conceivable, but I don't happen to know of any particular example unless it might be some of the gels. A solid with a solid suspended in it. We have many examples of that—an ordinary ruby glass—it is a colloidal suspension of gold in glass. Many of the hard enamels the jewelers use are colored glasses and to all appearances are perfectly transparent, but are particles distributed through the solid glass.

We have classified colloids in two different ways. We might speak of them in other respects. The study of colloids is in the same state that most of our sciences are either in or have gone through in their growing period. It is a vast collection of facts without a single adequate theory which will connect them all. Biochemistry is in pretty much that state; it is just emerging from that state. We have more facts than we can account for. We have inadequate explanation of facts; we are confronted by a wilderness. So we can't plough our way through the study in the same fashion a geometry book proceeds from one step to another. The best we can do is get on a hilltop and look down on it, and another hilltop somewhere else and look down, and from these different points of view form some notion of what it is all about and what the content of this science of chemistry is. We can pick out perhaps three or four points of view tonight: the preparation of colloids, the destruction of colloids, the colloidal particle as a kenetic unit, the colloidal particle as a micelle.

As to the preparation of a colloidal particle: the methods of preparation are more or less suggested by the fact that the size of the particle is the important thing. Therefore, we can either start with very fine particles and from them build particles that are of coarser size, or start with coarse particles and disintegrate them until they are of colloidal size. They are known respectively as the "condensation" method and the "dispersion" method. One of the most familiar dispersion methods is that of the atomizer for producing colloidal systems in gases. It is used in the humidifiers. The humidifier projects a very finely dispersed water into the air and produces a mixture which is truly a colloidal system when well done. The mixture evaporates, of course. An ordinary steam pipe exhausts into the air and produces a colloidal form. Those are condensation methods. That last is a condensation method from the steam. The first is a good illustration of a dispersion method. The dispersion method in the atomizer is used in spray lacquery. In liquidation we frequently can make a dispersion by partial solution. Take fairly finely divided particles and dissolve a little bit off them—you will get them smaller, and by keeping up that process what remains is of colloidal size. That is another method that can be used.

Then we have the grinding process which is coming into prominence and bids fair to be popular. As a matter of fact, in the paint manufacturing business the coarse particles are ground down in oil until they become a true colloidal solution of pigment particles and oil. Emulsifying is another common process of producing a colloid by dispersion method. You simply shake up your oil and water with a suitable emulsifying agent and the oil disperses itself and becomes colloidal. On the whole, the disperse methods are less important. Most of them are

prepared by condensation methods, by starting with true solutions and continuing into larger aggregates until we have particles of large size. One of the most interesting is the Bredig arc method. If two metal electrodes are brought together to strike an arc under water, the metal of the electric is vaporized and condenses in the liquid and produces a colloid. Colloidal solutions have been made for painting on surfaces and metallizing the surface. The chemical methods of producing colloids are pretty nearly as various as there are chemical reactions. It is only necessary to prepare a colloid by chemical reaction, to choose such conditions that some substances will precipitate in a very finely divided state. Most of us who have studied qualitative chemistry or analytical chemistry will remember we got some terrible precipitations that ran through filter paper. We know one or two colloids for you because I will want them to illustrate some things with. The first one is a red-gold colloid, and if the molecules will form decently we shall see a red-gold colloid. It is one of the most finely divided of the gold colloids. You may wonder how it is done. This is a very dilute solution of gold chloride and I am putting it into some warm water. If you are in the back of the room you may think nothing is happening, but up here we can see something is happening. To get a finely divided colloid I must go slowly. When it begins to precipitate, it sends forth a crystallization. If we have it very dilute these nuclei are very slow. We can make it go more rapidly by putting in a bit more of gallic acid. If I use a different reducing agent I would get a blue gold agent with coarser particles; if something stronger, I would get the gold coming down yellow; but you can see it is performing nicely now. This is the red-gold colloid. As far as you can tell by the appearance, it is a perfectly transparent liquid. This is simply by the reduction of gold chloride to metallic gold. The red stuff is metallic gold. You don't see the particles. It looks like perfectly clear liquid. It is colloidal, as I will prove to you. These colloids are tricky things—they may go on condensing itself while passing it on. When it gets back here it may be ruined. However, I can make them to last four or five years. I have one in my laboratory which I have had three or four years.

I am going to make one by a process of hydrolysis. This is ferri chloride. Putting it in the water it will produce ferric hydroxide colloids. I will put much more ferric chloride into cold water—there is much more in this than in this (holding up). In this case I have hydrolyzed it. The color of these colloids is much more intense than if the material were not in the colloidal state. That product can be dialyzed to take out all the mineral salts and the acids, and is sold in the drug stores as dialyzed iron. It has useful properties, to prevent bleeding, an astringent. Most any of our chemical reactions will yield colloids.

How do I know I have a colloid? The man who first named colloids tested them by determining whether they would pass a parchment filter or not—he was not the first to get them—dialyze. Even in the microscope you can't see perfectly clear liquid. It was not until the discovery of the ultramicroscope that it was possible to detect the particles. I will demonstrate the ultramicroscope: if we pass a beam of light through a colloid and then look at it from this point of view, you will observe the ray of light has been partly changed in its course, so that it comes out to our eye. It is exactly the same reason you can see a beam of light in a dark room, if the room is dusty. Go into a room and darken it; make a hole in a curtain. In college we clap two erasers together and then we can see the beam of dust. I will demonstrate that we can do exactly the same thing with a colloid.

(Demonstrates with beam of light).

So much for the preparation of colloids and the detection of them when once prepared.

The colloid as a kenetic particle: With the discovery of the ultramicroscope and the possibility of seeing the existence of individual particles, people began to notice and they discovered these particles were in continuous motion —the Brownian movement—not known to be true of colloidal particles. It was only a step from that observation to the conclusion that these particles were exactly like molecules. The molecules of a liquid are in constant motion, zig-zagging about from place to place. Particles of gas we have long known to be in constant motion. We can calculate their speeds, calculate the mean-free path, the distance it can travel before hitting another molecule on the average; the air being full of molecules, they will bump continually into one another. A Frenchman, Perrin, started out to measure these fellows—to measure the average length of the path, the average rate of diffusion, the kenetic characteristics of this particle; when all those were measured he computed a number. Avagadro's law was that under like temperatures of pressure, equal particles contain the same number. What is that number? It is not 6.061×10^{23}. It is 6 with twenty-three ciphers after it, in approximately a cubic foot of air. That number has been measured and measured with great exactitude. We know the number of molecules in a cubic foot of air as we know the population of Providence. That is well and good for gas. When you come to figure liquids, what do you find out? We get practically the same number, so close that we come to the conclusion that any discrepancies are matters of experimental error. We can determine Avagadro's number, the same number, by observing the behavior of the colloidal particles. We conclude two or three things: first of all, the colloidal particle acts like an over-grown molecule; second, the reality of the atom. Up to that time nobody had ever seen an atom or a mole-

cule. None has today, but we assume atoms to account for the behavior of things. Since, we have been able to state with great positiveness that these things really exist. They are not really assumptions to explain the things we see. The reality of the molecule is an outgrowth of this work—so all the kenetic theory of colloids. The kenetic energy of any moving object is equal to one-half its mass times the square of its velocity. If the mass is very great, the velocity is very small; the larger the colloidal particle, the slower it moves, until we get them so that it scarcely moves at all. The fairly fine suspension of indigo can be observed to just barely wiggle. I have observed very fine suspensions of indigo that just barely quiver a bit. You can see that under an ordinary microscope magnifying perhaps two or three hundred diameters. The motion of the colloidal particles is very slow compared to molecular motion; nevertheless, we can compute the velocity accurately and observe how far it travels under the ultramicroscope.

The rate of diffusion of colloids: I said they didn't diffuse—they diffuse very slowly. The rate can be measured. Turn your miscroscope up to a point here and here; observe the points. You can tell how fast it is diffusing past—very strong here. Take a tall cylinder of colloids and have it perfectly uniform; it settles slowly and very little. By using a great deal of mathematics they can figure out the different density they ought to get and different layers according to the kenetic theory; actual observations confirm it. How do they know the mass? They take a slide of a certain volume. Fill it with volume and count the particles. They know the mass so that they guess them, the weight of a single particle. Having the weight, divided by the density, you get the volume. We don't know the shape but assume they are spherical; we can compute the diameter if we know the volume. The thing about colloids of probably greatest practical use is what I spoke of, the micelle; and that means the colloid as an organized structure. These little particles that are so fine are not little homeogeneous things like a billard ball but actually have a structure. That structure has been demonstrated in a number of ways. Even the gold colloid is not simple particles of gold; each particle has a structure. What is the structure? I am going to take one pretty well known to you and that is the rubber latex. That consists of a suspension of rubber particles in a fluid. Those rubber particles have three layers, an inside and two skins. The inner skin is a hydrocarbon jelly, the next layer is a tough hydrocarbon, and outside of that is an albuminous coating. They have to remove the albumin by simple means and lift the rest of it. Then a man with an ingenious device set up his microscope and mounted a hollow needle on an adjustment and reached in there and with infinite patience would spear those particles, stick the needle in and pull out the hydrocarbon. There were those particles on the border line of not being particles at all. Take a fair hydroxide, a sol, which we have here. A suspension of iron hydroxide is not only iron hydroxide, the chemical substance, but it has around it a layer of charges. To be precise, I will tell you whether they are positive or negative. It is a positive colloid. We have an iron hydroxide particle and it is positively charged all the way around. That is all very fine. The sphere there positively charged immediately attracts negative charges; it will attract all the negative charges around loose, and you will get an electric double there. The inside layer positive and the outside negative charges. Those electrical charges are very important in determining the habits and life of the colloid.

The colloid has an immense amount of surface. In fact, it is a substance that is mostly surface. Colloidal chemistry is sometimes known as surface chemistry. Let me give you an idea of the enormous area of the outside of these particles. I am going to do it by simple calculation. Suppose we have a centimeter cube and cut it up into smaller and smaller cubes; note how the surface area increases as you chop it up. We have the length of one edge of the cube and the number of cubes and the total surface. We are going to start out with a cube one centimeter on an edge, and one such cube and surface is six square centimeters. We will cut up into cubes a millimeter. Take it and slice it ten times each way, we will get a thousand cubes. We shall have sixty mm. square. We will cut them again and we will have 10^6 or a million of them. We will have six hundred square centimeters. Cut them again to 1/100th of a millimeter, we will have 6,000. Cut again, you will have an area of six square meters. Cut twice again and you will have about half an acre. So, if you take a cubic meter of stuff and divide into 10^{18} of particles you will have about half an acre of surface on the thing. That is all on one cube. It is mostly surface. When you get down to the order of magnitude of a molecule about 6,000 square meters—and that is above five acres—if you take a cubic centimeter and cut it up into molecules you will have about five acres of surface. You can see the surface is the very important part of a colloid, and therein hangs the story. One of the important parts is that they will stick ot the surface. It is adsorption that makes the chalk stick on the blackboard. Fine particles will stick to a solid. The baking powder people tell you they keep the acid and the carbon of their powders separated by dusting with starch, and starch is an addition to the baking powder—so I have heard tell in their lectures.

A man whose business it is to go around mills in connection with fire hazards and dust explosions tells me that the capacity of dust to stick on exposed places is

beyond imagination. It is that dust and it doesn't have to be on the top of a beam; it will stick on the bottom as well. The tendency of these particles is one exhibition of adsorption. The colloidal particle will adsorb to itself almost everything in sight. The ferric hydroxide particle is positively charged. If you put into this solution some ions of a kind that will neutralize these charges, then we get a precipitation and it occurs in this way: as long as both are positively charged they will repel each other; neutralize the charges—there is nothing to repel each other and they strike and the particles build up bigger and bigger until they no longer remain suspended. A positive colloid will precipitate a negative colloid. That phenomenon is used in the analysis of certain dyestuffs which are colloidal. There are one or two dyes rather difficult to titrate. If you have an excess of either one, you have a coloring solution. It is a common method. A positive colloid will precipitate a negative colloid, and vice versa.

Wetting is a quality of a surface. It also depends upon what the wetting medium is. I recall there was a colored gentleman came into the office and sat down, handed me his card. He was a whitewasher by trade. He said, "I want to get some information. I belong to the Olney Street Baptist Church. We are going to have a debate. I have got to prove water isn't wet. I want you to prove it for me." I did explain to him that water of itself was not wet. Water will wet things. You have to have two things present in order to wet things. The process of wetting is to spread a thin fluid over a solid. Wetting is another adsorption phenomena. It is a property of the surface to hold on it certain kinds of liquid. I will give you an example. Take a beaker of water and put in a few drops of pine oil; shake up and you will find the pine oil gathers on the brass. White lead is made by the corrosion in the wet state; white lead as prepared is soaking wet. The paint maker takes the linseed water. It prefers the linseed to the water.

This phenomena of selective wetting is very important in many ways. You can have what we might call positive and negative effects. Mercury will not wet glass at all. It is repellant. No property of adsorption at all. Put a trace of grease on the glass and it will stick on in globules. Take a piece of cloth—water will wet it under certain circumstances. You well know the explanation of it. Ordinary adsorbent cotton has been treated to be adsorbent to water. Ordinary cotton does not wet right away. Treat it, it makes the cotton adsorbent which we have in the stores. Cover with a very fine coating of paraffin, it will repel water again. It is the positive and negative effects. The calcium stearates have a positive repellant action on water.

This manner of adsorption on the surface is highly important for the preparation of colloids. I am going to show you that I can stick my finger in water and not get it wet. I put in a kind of powder that comes from Northern Norway. It is the seed-bearing part of moss that grows up to Iceland. It is a very oily substance and therein lies its usefulness for that purpose. The children gather this, they tell me, and then have their fireworks. (Lights match and powder explodes.) It has greater affinity for human hide than water. Therein lies the whole philosophy of the manufacture of emulsions. You put something into that preparation to stay between the oil and water and it keeps the two separated. You get the film, and when the two particles bump up against each other, they do not coalesce. You can take any fine powder. Take this one. Metals are wet by oil rather than by water. It is the choice. Take zinc; it is wet by the oil preferably. Shake up the zinc dust and a little oil. Bye and bye you will see the oil is breaking up into globules, each one surrounded by a globule of zinc dust. You can see with your naked eye exactly the same thing that goes on with emulsions.

Not only does this surface layer consist of molecules, stuck on the surface here, but in many cases we are pretty well satisfied that those molecules are all standing on end and definitely arranged. In many of the soaps—the stearates—we find the sodium end is the end attracted by the molecule, the acid end; while the other end, the paraffin oil, is toward the oil. So we have a definite arrangement toward the surface. While there is a dispute, the main idea seems to be right. If you take sodium soap and water and oil and shake them up together, you will get an emulsion in which you have drops of water suspended in the oil. On the other hand, take calcium soap; you will get an oil just the reverse of that. You will get an emulsion in which the oil is a dispersed phase and the water is a solid. Unless I am misinformed it is the basis of many of our lubricating greases. It is getting the right amount of water emulsified in the oil in that particular phase.

QUESTION: Concerning ultramicroscopes?

ANSWER: There are two or three ultramicroscopes. The principle of the ultramicroscope is this: a beam of light proceeding in that direction encounters a colloidal particle. We don't know just what happens, but for some reason or other that colloid sends the beam of light out again at right angles. I don't believe the beam actually makes the colloidal particles wiggle but the reason is justified it would move it up and down vigorously and cause it to send a beam of light. What it probably does is disturb the electro-magnetic field in it. You never see in the ultramicroscope a colloidal particle in the same sense you see with the ordinary microscope. All you see is the

light source there. You can see right here. Look out into the sky at night. The stars have no shape; they are simply spots of light; you cannot detect the shape, whether round or square. A better illustration: if you stand close to a lighthouse you can see the bars and windows; as you get farther and farther away it is only a spot of light. So all you see when you observe colloidal particles—a spot of light.

QUESTION: What I didn't understand was that you spoke of the colloids being so small viewed with an ordinary microscope?

ANSWER: Yes. It looks like a skyrocket bursting; they go in all directions. I was trying to answer your first question. It is largely a matter of intensity. This becomes actually a solution of light. This is one thing. Another way: a fine particle is so transparent that the light goes right through it. The particles must act on it or you wouldn't see the color. There are many varieties or types of ultramicroscopes.

QUESTION: What is the definition of a micelle?

ANSWER: It is a colloidal particle. In the earlier days the main picture of colloids was very mixed up. People made definitions that haven't stuck. As far as we understand it, when we speak of the micelle we are thinking of the colloidal particle as a definite unit.

QUESTION: Is it one individual?

ANSWER: It is one individual. More of them, we speak of them in the plural. We speak of them this way: we will destroy the micelle—we will destroy all of them. It might be produced in that way. A number of micelles might aggregate to form a bigger micelle.

QUESTION: In vat dyeing you get foam spots. In the foam, the surface of the bubble, does the dye have a tendency to coagulate again?

ANSWER: Not exactly. Take the surface liquid and have some salt dissolved in that liquid. The concentration in the immediate surface layer will be greater than in the body of the liquid. That is a species of adsorption. It concentrates in the surface layer or diminishes in the surface layer. The concentration is higher there than in the bulk of the liquid. Consequently the vat dyes, whether in true solution or colloidal state, might have a tendency to concentrate.

QUESTION: It coagulates there?

ANSWER: No. That means a destruction of the colloidal particles. It means they gather together and finally precipitate. It is not necessary that they precipitate at all. Ordinary salt solution is more precipitate in the surface layer than down below. You can think of it in another way:— I have this experiment in the college—they measure the surface tension of water. If their work is well done and clean they get 74°C. I say, "Touch the tip of your finger in that water and measure again." It will drop to around that figure something over 10 or 15 per cent. You can wash your hands as clean as you like and there is still enough foreign matter to drop the tension to that extent. We did the same thing and made some experiments with cloth. We took a piece of cloth and got it as clean as we could with ordinary methods, and cut it up into particles. We took soap solution, steeped it in solution and measured the strength of the solution. We found it diminished considerably. We tried it again and again. The cloth carried out much more soap than it did water, showing much more soap adhering on the surface layer. You can do that with many things. I haven't been engaged with dyeing for seven or eight years and have forgotten many of the details. Tell me if I am wrong. Certain of the colors of the dyes can be dyed on to cloth—diazo dyes—and then developed. Not so bad, is it? All right so far. They develop frequently with beta-naphtol. Dyeing is an adsorption process. You can reverse the thing; stick the cloth in the beta-naphtol and the beta-naphtol will be absorbed. Take it out and wash it, it sticks there.

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A CENSUS FOR ALL OF US

IT IS so easy to criticize. Perhaps the Government in its various departments receives more than its share of condemnation from the average layman. Seemingly certain of them cannot be mentioned without an added slur about the alleged tardiness with which their reports are compiled and distributed.

This is a rather severe indictment, and for that particular reason it may be advisable to look further into the matter. Is it logical to assume that the Governmental officials alone are responsible for these delays?

An appeal recently has been issued by W. N. Steuart, director of the census, to all manufacturers in the country that they expedite the compilation of the data in the "Census of Manufacturers," already received by them, by returning the blanks properly filled in as soon as possible. Whereas it is generally assumed that a great deal of time is necessary for the actual statistical work by the Bureau of the Census, yet that department has stated that a period of only three weeks is all which is required on their part. Allowing a reasonable amount of time to the individual manufacturers, it might be expected that the preliminary reports could be published in the early Fall. In fact, Washington is bending every effort to this end.

A certain degree of reticence in contributing this census information has been noted. Doubtless much of this is due to a misconception on the part of the manufacturers whether such data might be open to the perusal of others. However, any such fear is unjustified, according to Mr. Steuart. For he guarantees any figures supplied to him in this manner will remain absolutely confidential. They will never be used as a basis for taxation, but purely for statistical purposes. No person, not a sworn employee of the Bureau of the Census, will ever be permitted to examine any reports whatsoever.

In this keen age of competition there is no need to recount the only too obvious advantages to be found in a speedy publication of the census. Every manufacturer would profit in checking up on his own plant in relation to others in the country—particularly in respect to the value in dollars of industrial output per wage-earner and plant in addition to the actual cost of materials throughout the United States.

A period of more than *sixty-eight weeks* elapsed between the time that the last appeal for information from manufacturers was issued and the time when sufficient returns were received by the Bureau to justify closing its books. The present request is a challenge to American industry. The commonsense manufacturer will see that he himself will profit by co-operation.

A WORD TO THE WISE

NO SMALL amount of confusion occurs every day because of the misapplication of terms. A complete course of thought or action may be postulated upon a certain word which only too often is not exactly what it may seem. Of late there has been a very decided emphasis upon the word "coalition" in its relation to the United States Senate. To judge by newspaper reports, a new and still more important "coalition" is formed each time a vote is recorded in that august body. This is *not* the actual case however. In looking back on the issues of the Congressional Record one finds difficulty to discover two successive roll calls in which the alignment is identical.

Such was the case fifty years ago and there has been no appreciable change even up to the present day. Yet, recently in speaking of the various causes of the Tariff, this "coalition" business has been fed to the public with a silver spoon. Fears have been aroused lest, because of some iron-bound "coalition," provisions already settled upon be brought up and reconsidered yet once more.

It is well for all to watch what we read—then to inquire as to whether we can rely implicitly upon the sensationally bold type of the headlines.

THE STITCH IN TIME

WHOLEHEARTED co-operation should be given to the Greater New York Industrial Safety Campaign, sponsored by the Merchants' Association of New York, which begins to-day. Governor Roosevelt and the State Industrial Commissioner both have pledged the active assistance of the Commonwealth's administrative officers in the campaign.

Statistics show an alarmingly increasing number of industrial accidents and deaths, as a result of such accidents, in New York State, and particularly New York City, during the past year. There have been more than fifteen thousand persons killed outright or maimed for life in addition to three hundred thousand experiencing lesser injuries. The financial cost of these calamities is in the neighborhood of sixty million dollars which, in itself, is a tremendous drain all along the line.

This campaign will be carried out in all five boroughs of the city. Fifty thousand New York firms are eligible to participate. The concerns are those engaged primarily in manufacturing, installation or operation activities, the only firms not eligible being those interested in the transportation of passengers or material. There are prizes—for the campaign has, as a feature, certain rewards for effective accident prevention work. But these prizes, while an inducement, remain second to the general effort on the part of all in whom responsibility devolves to promote accident prevention and make the campaign worth while.

Certainly it would be a remarkable tribute to American industry if this same movement would be carried on throughout the country, both in the cities and in the various States. It is by the active realization of such an effort that America can maintain industrial conditions which will foster happiness for its millions of workers.

Random Thoughts On Research

Research for the "Long Pull"

THE research of greatest ultimate value to the textile industry will consider principle first and then process, although as a matter of expediency, the writer proposes that a start be made from present-day processes. It would amount to the same thing in the end, a delving into causes and principles and then possibilities of new or improved processes.

Whatever the approach, the aim of fundamental research in almost any industry should be along the line of "finding out more about it, and especially the scientific mechanism of its processes rather than an attack on particular difficulties."

Here, perhaps, we should stop for a little distinction. We must not confuse fundamental research in general with fundamental research in textiles. There is evidently the thought in some minds that such work should be carried out without thought of utility and perhaps without any reference even to textiles.

A research worker on a problem where real original thought is required can undoubtedly accomplish more if he is not pestered with the thought that somebody is anxiously awaiting his result. He may want to lay the whole thing aside and mull it over for a time, and then perhaps go at it from a new outlook. Time and utility must not be made too important.

On the other hand, the work as a whole must be useful and have reference to the textile industry. It must be concerned with utility and somewhat with time; it cannot wander about indefinitely, no matter how fundamental it may be.

The ideal fundamental work in science is for the university. According to the amount of support, it can extend the frontiers of pure science and learn all about such fundamental things as electrons, radiations, wave mechanics, and any number of others.

Setting out to define boundaries immediately shows that there may be none, and perhaps it will be clear that there is a highly "theoretical" field where our work would not wander unless some specific problem was chased through the fence.

Therefore, while the individual may have some freedom, the program as a whole must aim at fairly definite things, and not be too fundamental.

Again, what should be the scope of the proposed program? Should it start with electrons, biology, agriculture or the sack of wool and bale of cotton? Shall it cover everything just through the finished cloth, or go on with its relation to the health of the wearer, or into details of the uses for mechanical fabrics? It seems that it must necessarily start in the middle, with things with which we are familiar and work both ways, toward better raw materials and toward better products.

There must be something to the fact that publicity agencies for universities, the writers for disseminators of popular science, popular science books, and press notices all hail any striking scientific discovery; but if they possibly can they point out a use for it and hail that even louder. The interest of the world is really in applied science. Perhaps our research does not want to be too fundamental or our science too pure, for in the last analysis, utility is the main urge to the support of most scientific research.

It Satisfies

That lab of mine's a dirty place,
I like it.
Some even say it's a disgrace,
I like it.
The dusty bottles on the rack;
The fume hood and its gas attack,
The cuspidor that's talking back;
I like it.

The fumes are guaranteed to kill,
I like it.
They drive you to the window sill,
I like it.
They make you cough and make you rasp;
You hold your nose, for breath you gasp;
T. B. will conquer you at last.
I like it.

The stuff you mix may knock you dead.
I like it.
Or else blow off your only head.
I like it.
You may get killed, you may get burned;
But for better times I've never yearned.
In fact there's one thing that I've learned,
I like it.

—*The Catalyst.*

Chemical Economics

By H. C. MORAW

Chemical Division, Bureau of Foreign and Domestic Commerce, Washington, D. C.

THE subject of chemical economics may by appropriate stretches of the imagination be interpreted to mean anything from a study of electrons and ions to chemical cost accounting. At any rate, it is broad enough as a subject to warrant treatment beyond the scope of a short discussion and, therefore, by more limited theme is: The application of science to industry as an aid to marketing. This may logically be called one of the important phases of the general subject of chemical economics and is best presented by means of brief discussions of important chemical developments in relation to chemical trade promotion as viewed by the Chemical Division of the Bureau of Foreign and Domestic Commerce.

Greater public recognition has come to scientific work and workers in recent years than in any previous period. The public has been impressed by the fact that some branch of science is back of most of the new developments which contribute to comfort and progress. Such developments as insulin, electron tubes, talking pictures and the like are a few of the many which have enhanced public appreciation and respect for scientific methods. In like manner, the reaction of the public to this new scientific world has had its counterpart in a widespread recognition by industrial leaders of the economic value of the application of science to their problems. In financial circles this is reflected by the greater degree of readiness with which capital is made available to industries utilizing scientific facilities in production.

Industries which have adopted accurate scientific research to determine the "why" and "wherefore" of chemical reactions have passed from the epoch of "rule of thumb" or empirical methods to the epoch of exact methods requisite for transition to mass production and mass distribution.

More than ordinary significance must be attached to something which is epoch-making. It is but natural, therefore, to wonder what is back of the extensive current recognition of science. Has the prophetic vision of the commercial world revealed dangers lurking in the future? Is industry striving to build a more dependable set of rules? These and similar questions appear to be answered affirmatively by industrial recognition of the power inherent in the method of science, which in its essence is that of truth or fact seeking. Thus, industry and commerce more generally are awakening to the power of truth or facts as a guide to progress. By adopting such an ally business can exercise a greater degree of control over its own future. Thus, forecasting and predicting in the usual sense of those terms can be displaced by scientific methods. However, this does not imply that imagination and visualization, which are important components in man's progress, can be dispensed with. A homely illustration of the value of imagination appears in the story about the prize fighter who, weakened by heavy blows from his opponent, was being comforted by his second between rounds with the usual water, towels, etc. This faithful second seeing that he needed something more, said, "Anticipation, boss, that's the thing. Try and imagine what he's going to do to you, then you won't be surprised when he does it."

By making use of available facilities it is possible to anticipate changes in business conditions so that an organization will not be knocked out by the opposing forces of new developments, or at least may not be surprised when it happens.

Those whose interests are at stake in the European fixed nitrogen industry, for example, may perhaps be disappointed if the expected increase in world consumption of nitrogen fertilizers does not materialize in a reasonable time, but they are, at least, fortified with a knowledge of the present excess world production estimated at over 200,000 tons on a pure nitrogen basis. Moreover, developments favorable to the world nitrogen situation are transpiring. For example, it has recently been shown in New Zealand that ammonium sulphate applied in the fall and winter months causes pastures to remain green throughout the year. New Zealand is one of the chief dairying countries of the world and it is assumed that under similar climatic conditions in other countries similar results may be obtained. Thus this industry may go down in history as one of the important factors contributing to the world's supply of contented cows.

In the United States the recognition of the value of research to industry is reflected in some of the research organizations already functioning, such as the National Tanners' Research Laboratory, the Mellon Institute of Industrial Research, the National Canners' Association, the Institute of Paint and Varnish Research. These and other associations of industrial groups have research laboratories actively working on group problems, besides the many large and small research organizations of individual corporations.

The widespread adoption of science as a partner to industry is not purely a philanthropic move. In some

branches of industry a condition of staleness prevails until a new product or new use enters the market. Scientific investigation of the products and services of the "sleeping" business serves as a bracer and inducement to further capital if warranted. This has recently happened to the artificial ice and refrigeration industries. The coming of the electric refrigerator served as a spur, if we may be guided by what is transpiring along research lines directed by associated groups in this industry. In this instance the application of scientific research may be considered the means of self-preservation

This same reaction of industry in the United States is decidedly in evidence in such foreign chemical producing centers as Great Britain, Germany, and France, where it is realized that exact scientific research must be depended upon to guide the future of the chemical trade, as well as all related branches of industry; and it is further realized that commercial and economic research are absolutely essential if industry and commerce are to make progress.

Italy, as well as the other countries of Europe already mentioned, is feeling this urge to more scientific consideration of facts involved in commercial undertakings and Mussolini as autocratic dictator is deliberately fashioning the destiny of his country through the application of these principles of scientific, commercial and economic research. The recognition of the value of scientific approach to the problems of industry is also extending rapidly to more remote countries. Definite reports of consideration or the adoption of scientific methods have been received by the Bureau of Foreign and Domestic Commerce in Washington about the sugar and rubber industries of Sumatra; the mining industry and railroads of South Africa; the mining, fertilizer and related chemical branches of Australia, and others. The character of this development in different countries varies in its detail, but it generally takes the form of centralization of management of technical and business directors effected by consolidations and amalgamations, in general supported or encouraged by the respective governments, with the ever present application of scientific and commercial research to problems of industry and trade.

In the foregoing, reference has been made to the widespread recognition of the value of science as a promoter of trade and as a fortification against changes in business conditions, which may require quick changes in processes and products. An equally important development is that many leaders of industry have also recognized the need for better facilities by which to detect changes in business conditions. This is but another branch of science and is called business or economic research.

Just as the United States government has given recognition to the value of chemical technological research in practically every executive department and particularly in the facilities established in such bureaus as Chemistry and Soils, Hygienic Laboratory, Fisheries, Mines, Chemical Warfare, and Standards, so the Federal government has given recognition to the value of business research in the Bureau of Foreign and Domestic Commerce. This recognition is in part a reflection of a wider public appreciation of the importance of this factor in industry and its indispensable function in relation to our national prosperity and well being.

The greater complexity and the greater magnitude of the chemical industry of the present era have led to changes in the methods of developing new products, which emphasizes the importance of information on production, stocks, sales, and new uses. Formerly a new product was developed on a laboratory scale, then semi-plant scale; the plant was then built and the product produced. The market was then found fairly easily due to limited competition. Today, it is more generally assumed that the technological problems can be solved. It is known, for instance, that science has accumulated a vast store of research information and experience with which to meet conditions as they arise. The new project, therefore, is first considered from the standpoint of information about the uses, the market and the competition to be met, after which the chemical research and development takes up the problems.

The Bureau of Foreign and Domestic Commerce is endeavoring to meet this need for the American chemical industry by appropriate co-ordination of all the available marketing and technological information that can be obtained here and abroad. Illustration of such co-ordination will be referred to later.

The recognition of economic changes affecting the demand for a given product may logically be followed by the recognition of an opportunity for another product. Since the recent extraordinary advances in chemical research have provided so many new processes, new products, and new tools, it is but logical that the struggle to adapt the new properties of the new products to utilitarian purposes of the human race will be on a grander scale than ever before. In this struggle, the economic and technological inter-relation of different raw materials and their various derivatives should receive more intensive study. For example, consider such raw materials as corn sugar and hydrocarbons. By selecting suitable ferments, corn sugar may be made to yield different alcohols, or ketones, or lactic acid, or vinegars. These may be used as such or converted to other derivatives. On the other hand, a given hydrocarbon raw material such as ethylene may by one process be converted to acetic acid today, but with a change in the market conditions the same raw material may by another process yield another hydrocarbon or derivative for which there is a better demand. The ability of chemical science to change many of our important raw materials or end-products in accordance with the market demands may be called production flexibility or product flexibility. Whatever it may be called, it must be considered as a stabilizing factor for the chemical and related industries.

The foregoing is an abstract discussion. To help American industries attain, in so far as possible, a steady flow of

trade is a brief and practical description of the primary function of the Bureau of Foreign and Domestic Commerce. Distinct from all other agencies of the government, and not comparable to private or industrial bodies, the Bureau endeavors to interpret the needs of the various branches of industry and serve as their impartial trade promotional agency.

Briefly, the functions of this Bureau are to help the chemical industry to decide what can be sold, where it can be sold, when it can be sold, and how it can be sold. In order that there shall be no misunderstanding of the Bureau's chemical activities, it should be remembered that it has no laboratory, but instead its tools and apparatus are in the form of statistics, reports, and personnel equipped to co-ordinate and evaluate the information collected from all over the world by the various officers abroad and the Commerce Department and the State Department. The Chemical Division, of which C. C. Concannon is chief, is the particular unit in the Bureau of Foreign and Domestic Commerce handling all matters pertaining to that tremendously important and widespread field which is known as the chemical industry.

What is the chemical industry? Different definitions are variously offered depending upon individual viewpoints and different countries involved. In Europe the chemical industry is generally accepted as including the manufacture of artificial silk, petroleum refining and a number of other large and important undertakings which we do not generally consider as strictly within the so-called American chemical industry. It is necessary to have a definition of the term "chemical industry" in order that there may be no misunderstanding when reference is made in consulting statistics or through general trade references, and since there is a wide divergence of personal opinion, the Chemical Division of the Bureau of Foreign and Domestic Commerce has set up what must necessarily be a somewhat arbitrary grouping. Many practical considerations are involved in developing this grouping. Falling within the purview of the Chemical Division are a multitude of chemicals and allied materials in well known groups, such as the heavy or industrial chemicals, dyes, drugs, and pharmaceuticals. In addition, this division handles matters pertaining to insecticides and disinfectants, fertilizers and fertilizer materials, plastics, explosives, paints, pigments, naval stores, toilet preparations, coal tar products, biologicals, and the like. In this allocation certain products, such as rayon, paper pulp, glass, etc., are for practical purposes included in the activities of other divisions of the Bureau, although they are definite chemical commodities.

Reference has earlier been made to the co-ordination of economic and technological developments through the Bureau. Apropos of this, among the observations made in the Chemical Division recently is an interesting economic change which is taking place in our domestic market involving diminished supplies of niter cake and salt cake. The chemical developments affecting the change in supplies of these materials are the adoption of ammonia oxidation units in sulphuric and nitric acid plants and increased production of synthetic hydrochloric acid, respectively. The principal cause of this situation is attributed to increased use by the pulp industry, sulphate pulp production being approximately 725,000 tons in 1928 and 1,000,000 tons in 1929.

Inquiries were recently received in the cottonseed pressing district of the South from foreign sources for supplies of cottonseed hull bran at $15 per ton delivered in Europe. This material has until recently been one of the many agricultural waste materials. But investigation by the Bureau of Standards and other agencies showed it to be one of the best sources of xylose as well as furfural. Adequate supplies of the latter are available from other sources, but xylose has heretofore been more or less of a laboratory curiosity. Biological laboratories have been accustomed to paying at the rate of $100 per pound for their requirements. Now it is expected to be available for less than one dollar per pound.

Technological and economic developments differ as between one country and another, depending upon the availability of raw materials. These developments often have significant application in different countries at another time. Rumania, for example, a country endowed with certain natural resources, numbers among its most important assets rich natural gas basins. But because of inadequate supplies of coal suitable for coking, the economic growth of the iron, steel, glass, ceramics, and cement industries in that country will depend largely upon the rational development and extended use of these gas deposits. Perhaps authorities who advocate greater use of gas, in place of coke and coal as fuel in some of these industries in other countries may subsequently profit from whatever developments along this line are evolved in Rumania.

One of the interesting inquiries which recently came to the Chemical Division was for information about the prevention of corrosion of coal cars by the calcium chloride now used widely for preventing coal dust annoyance. This is an illustration of a new problem arising as a result of a new idea which suggested itself to someone for adapting a well known chemical to a very logical and practical use. The corrosion problem in this instance may require a new investigation for its solution, but it is recognized as a serious economic problem about which the railroads are vitally concerned because of the probability of diminishing the useful period of a coal car from about 10 years to a much shorter period.

Coal in one form or another is one of the most important items in the economic picture of the world. Intimately associated with it are international relationships and sociological problems of vast signifi-

cance. It is as a raw material for chemicals, however, that coal is really of most interest.

The distillation of coal and the utilization of coal tar products is a pre-eminently important and even a romantic chapter in the present age of chemistry, but it is quite likely that the hydrogenation of coal may prove in years to come of even greater interest. As a matter of fact, hydrogenation developments and commercial agreements associated therewith are of greater significance than is at present generally realized. In the United States we are interested in the hydrogenation of coal only in an academic way. The hydrogenation of petroleum is of immediate and deep interest to us and though undertakings in this field are but in their infancy, economic results of magnitude may be expected to develop. It is the opinion in some quarters that the oil industry is hampered by irrational production and distribution, and the application of the principles of hydrogenation to the production of oil will result in more orderly marketing of petroleum products. The application of science to industry as an aid to marketing is very apparent in this case.

Regarding the hydrogenation of coal, the economic outlook is more complicated than in the case of petroleum. From the chemical and economic standpoint, coal both as a fuel and as a source of by-products must be studied with a view of developing a proper and rational treatment. Conditions vary in different countries with respect to kind, quantity and quality of fuel supplies; so that what is rational for the coal industry of one country may be irrational for another.

The United States, England, and Germany are three typical and outstanding examples of countries deeply interested in these fundamental problems, but economic conditions in each case are quite different and therefore each of these countries is approaching the problem in a different way.

The change in the economic position of the wood distillation industry, which was threatened by synthetic acetic acid and methanol, has been deferred as a result of the tremendous growth of the rayon, lacquer, cellulose acetate, plastics, and related industries, with their requirements for these chemicals. These new domestic consuming outlets have moreover reached such magnitudes as to use not only the acid equivalent to the acetate of lime formerly exported but require imports of acetic acid. For example, in 1928 exports of acetate of lime were 5,600 tons, compared to 50 tons in 1929. In the latter year, nearly 15,000 tons of acetic acid were imported or an increase of 6,000 tons in a single year.

The past, present and future of phenol constitutes a case in point which fits in readily as a shining example in any thesis in the field of chemical economics. Increased demand in the United States recently for phenol was such that manufacturers were compelled to obtain supplies from sources not previously utilized. A large part of this demand is due to growth in the synthetic resins industry. The estimate for 1930 output of phenol by "Chemical and Metallurgical Engineering" of 50,000,000 pounds is apparently based upon rate of growth of the synthetic resin production in the recent past. The rise of this industry is indicated by the growth in output from slightly under 13,500,000 pounds in 1927 to nearly 20,500,000 pounds in 1928, and somewhere between 33 and 40 million in 1926. For 1930 writers in the above journal have estimated that 80 to 90 million pounds of synthetic resins will be produced in the United States. Some observers consider that demand for phenol a few years hence will greatly exceed these estimates.

As a part of the general application of scientific knowledge to enhance the efficiency of industrial processes, water treatment is receiving a greater share of attention. In England authorities estimate that the weekly boiler scale accumulations are 50,000 tons. Loss of efficiency due to boiler scale of 1/150 to 1/9 inch thickness, varies from 9 to 16 per cent. Tests conducted in 12 American laundries, where the hardness of the water varied from 3½ to 20 grains per gallon, showed that an average saving of soap of 66 per cent was accomplished by the chemical treatment of water.

It is possible to cite almost without end examples pertinent to the subject of chemical economics which show in one way or another the application of science to industry as an aid to marketing. The synthetic organic chemical industry is particularly rich in such references. The same is true in the fertilizer industry—an industry which, by the way, is destined to play a much more significant and important role as time goes on.

In any discussion in which reference is made to the American chemical industry, it is of interest to realize the magnitude of the industry. The value of the United states annual production of the groups classed as chemical commodities is approximately $2,750,000,000, which is practically as great as all other world producers combined. By deduction, it is likewise obvious that American chemical consumption is also practically equal to that of the rest of the world combined, though we represent but 1/15 of the world's population. Perhaps the magnitude of United States chemical production can be better appreciated by comparison with the estimated total world production, which was placed at $4,154,000,000 for 1924, as reported at the Geneva Conference. At that time our chemical production was over 47 per cent of the world total.

While the United States, Germany, France and the United Kingdom represent over 80 per cent of the world's chemical production and consumption, Amer-

ican chemical consumption is relatively twice as great per capita. Aside from catering to their own consuming demand, these four countries likewise supply four-fifths of the world trade demand. The United States, however, accounts for but one-fifth of this exotic demand. We are, nevertheless, not neophites in world trade for as far back as 1806 we have recorded export of $53,000 worth of medicinals. About 1830 production increased faster and greater efforts were spent in finding export markets.

Total exports of chemicals from the United States are now over $200,000,000 annually, or about 8 per cent of our production. The principal foreign producers, however, export from 15 to 35 per cent of their production. Estimates place world exports of chemicals and allied products in 1913 at $762,000,000 and in 1927 at $1,072,000,000 or an increase of over $300,000,000.

In connection with this reference to American exports it is interesting to recall the statement of President Hoover while he was Secretary of Commerce: "To create a sense of need abroad for our particular goods—to induce the purchase of them—is a science in itself."

Viewing the world chemical trade as a whole, the American chemical industry is not so much concerned with the so-called danger of over-production, which is apparently the main factor leading to the European cartels. On the contrary, the viewpoint which seems to fit in with American aspects is that consumption can continuously be expanded by maintaining high purchasing power and intensive cultivation of new wants, and stimulation of trade in the usual channels.

The expansion of the American paint industry is a noteworthy example of constructive progress in sales in the face of apparent over-production. In 1899 the output of this industry was valued at $70,000,000; by 1914 it had more than doubled (to $147,000,000); then in spite of apparent over-production more than trebled again (to $527,000,000) in 1927.

Another comparison is appropriate in relation to the subject of production-consumption. It may be referred to as human wants versus human needs. Consumption of foodstuffs is limited by the nutritional demands of the world population. Consumption of manufactured utilities is limited by the fostered desires and ability to buy. Hunger can be satisfied but the desire for things to use is unlimited. Chemicals and related commodities fall within the latter category, so that in general, unlike European thought, agreements designed to limit production of chemical commodities receive no consideration by the more enlightened factors in this industry.

For the benefit of the uninitiated it seems appropriate to explain briefly the aims and activities of the Chemical Division of the Bureau of Foreign and Domestic Commerce in order that those who wish to make use of the Division's facilities may do so with efficiency and dispatch. The Division was established eight years ago with the object in view of rendering practical service to American business in the broad field of chemistry and chemicals and allied products. Information is regularly distributed on inquiry from the Chemical Division to private individuals and members of the chemical industry, respecting the size, absorbing power and characteristics of the market in the United States and foreign countries for the various types of chemical commodities.

To make this information available to the industry, the Chemical Division secures basic data concerning markets and industrial developments through the foreign field force of the Department, consisting of about 250 officers and over 700 consular officers of the Department of State, and on the domestic situation through the various agencies of both the government and trade organizations in America, collates the findings and transmits them by letter, radio, wire, special mimeographed circulars, the Department's weekly periodical, "Commerce Reports," bulletins and through press releases to 600 or more trade papers, which, by special arrangement with the Bureau, carry a regular foreign trade section or department for that purpose.

Offices of the Bureau are maintained in some 58 American cities and are comparable with "service stations" in saving valuable time for those desiring the information available through these offices. For example, the number of calls received by the Bureau for service in 1929 was over 3,500,000 as compared with about 1,000,000 in 1923-25.

In general, the information is distributed by the Bureau without charge except for a few publications which are furnished at cost of printing. Certain confidential information, such as actual sales opportunities, however, are reserved for American firms who have registered their names with the Bureau on what is called for convenience, the "Exporters' Index." This is to insure that the Bureau's aid is not misused for the promotion of any but American manufactures.

Approximately 4,000 American chemical firms are so registered. A greater number should take advantage of the invaluable and specialized information and service which can be had upon request. In conjunction with the other divisions, the Chemical Division can assist an exporter with the record of financial and credit reports on over 300,000 foreign firms, supply specific trade opportunities for the sale of chemicals, or details of shipping, documentation, and consular procedure, marking, labeling, packing for lowest customs duty, tariffs in foreign markets, clearing difficulties at port of entry, trade-mark and patent registration in foreign countries, general economic information, and advertising abroad.

Inasmuch as technical and economic developments

in foreign countries are frequently applicable to our problems, the government through the Chemical Division of the Bureau of Foreign and Domestic Commerce in co-ordinating foreign developments with related conditions here is extending to American industries a service distinct from any other organization.

More intensive study is needed of the relation of technological developments to economic conditions, if a greater realization of commercial development of new commodities and stabilization of established trade is to be realized. To express the situation in a few words, greatest success results from the chemist thinking of his developments in terms of economics and the economist interpreting his facts in terms of chemical developments.

[*Presented at the meeting of the Rochester, New York, Section of the American Chemical Society, February* 17 1930.—EDITOR.]

Dyeing Paper Fabrics

(*Continued from page* 142)

in getting good results. To dump a batch of paper goods into a boiler with a strongly alkaline soap and boil it for an hour or so would be inviting disaster. The preliminary treatment is freeing the material from dust and broken fiber by means of a vacuum cleaner applied with gentle tapping or beating to loosen up the foreign matter. From that the batch is run into a warm, dilute solution of neutral soap which is kept in motion so as to wash out more of the dirt without the application of any friction to the surface of the material.

Having, in this way, gotten rid of the dirt, the yellowness is overcome by passing, perhaps once only or it may be needed more often, through a dilute, warn solution of sodium hypochlorite (Eau de Javelle). It will be necessary to rinse between each passage and the runs should be as rapid as possible in order to avoid exposing the paper to too prolonged a bleaching each time, otherwise the fiber may be destroyed. As alluded to above there will be noted an opening up of the fiber and further treatment is now required to reproduce the original condition. After rinsing free from bleach, the material is run through a mangle of which the bottom roll is kept thoroughly wetted with a one per cent solution of glycerine in water to which is added a trace of glycol. This bath combined with the gentle pressure has the effect of contracting the pores of the paper yarn and the batch may then be dried up, hot pressed and calendered when it will be found to be nearly as good as new.

Much more use could be made of paper fabrics if more trouble were taken over the dyeing so as to produce more artistic effects. Crudeness of coloring fits them only for the lowest classes of trade and brings the material into disrepute when there are many openings in the way of internal decorations for which they are eminently suited.

Projects in the Federal Program for 1930-31 That Affect the Dyestuffs Industries

By WALDON FAWCETT

NOT since the World War has the Federal Government made up a "program of work" so significant for the dyestuffs industries as the one for which Congress is making the necessary appropriations this winter and spring. The Program of Work is the balanced schedule of research activities, tests, and experiments, to which the several departments and independent bureaus of the Government are committed for a year in advance—the fiscal year embracing the period from July 1 to June 30.

This synopsis must, of necessity, be worked out more than twelve months in advance because it is requisite that all the slated endeavor—continuing projects as well as new projects—shall be formally approved by Congress and financed in the annual supply bills, so called, which it is customary to dispose of early in each succeeding session of the national legislature. Advisedly has it been said that this many-sided research adventure is a "balanced" program. The Bureau of the Budget passes upon and reconciles the various proposals of the several departments and brings the total within the preconceived aggregate allowance of expenditures before the tentative draft is offered for the endorsement of Congress.

That the slate of governmental service to the dyestuffs industries is unusually full for the year to come is due in part, of course, to the announced determination of the Presidential Administration to do everything possible to help business to maintain its gait in the face of a tense situation. In another part, the number of contacts of Federal research with the dyestuffs industries is attributable to the cumulative effect of a steadily expanding research movement—a movement that is particularly stressed in the case of chemical research. Finally, there is the element of chance or coincidence to further enrich the program of 1930-31, because it happens to be the beginning of a decade. This is most notably exemplified in the major census operations of the months immediately ahead—a Census undertaking which, for the first time will include not only a Manufactures Census, or census of production, but a corresponding census of marketing, known as the Census of Distributors. This latter is bound to constructively enlighten dyestuffs operators if from nothing more than its disclosure of average rates of merchandise turnover and the state of stocks in suspension.

In the program soon to be unfolded is another statistical project which should be of tangible value to the dyestuffs industry albeit the contact is indirect rather than direct. A Permanent Nation-wide Survey of Retail Credits would seem to be several times removed from primary marketers of dyes. As a matter of fact this, the latest addition to Uncle Sam's business reportorial machinery, is counted upon to render distinct service at all commercial and industrial levels by affording the most comprehen-

sive gauge of collections and the best barometer yet available for the forecasting of business trends.

Incident to the Survey of Credits, the Government plans to investigate thoroughly the why and wherefore of what has been revealed in a preliminary investigation as the gnawing cancer of retail credits, viz., the "returned goods evil." Federal specialists have discovered that matters have progressed to the stage where the goods returned to leading department stores run as high as 33 1/3 per cent of gross sales. In the analysis of the alleged causes of commodity rejection and the study of possible remedies (including a charge for return or exchange) there may be reactions that will extend to all the color-using industries.

On the side of scientific research the vista is no less rich in potentialities. At the U. S. Bureau of Standards an allowance of upward of $16,000 will enable continuance and expansion of the work in color standardization—comprising the development of color standards, methods of manufacture, and color measurements. The past year has brought further progress in the standardization of Lovibond glasses for the American oil chemists. Over one thousand red glasses have been calibrated in terms of the Bureau standards. A current project consists in the evaluation of blue filters in co-operation with the national laboratories of Great Britain, France and Germany.

During the year to come the Bureau specialists will address themselves to completion of the task of providing reproductible working standards of sunlight and daylight, for the determination of color temperatures. There has been produced and tested an extensive series of optical filters which will convert incandescent light sources ranging in color temperature from 2,300° to 4,000° to the color of mean noon sunlight and that of the present laboratory standard (color temperature, 2,848°) to the color of a black body anywhere between 3,500° and 10,000°. There are being added filters for giving the color of an overcast sky, for converting the acetylene flame standard to that of mean noon sunlight, and for giving sunlight color at the summer solstice and the winter solstice.

If Congress approves, the Industrial Research Fund at the Bureau of Standards will be increased, this next year, by $21,000, bringing the allowance to $225,000. This is the fund through which the bureau co-operates extensively with industry through the research associate plan. There are now stationed at the Bureau about 100 research associates and assistants representing 48 technical organizations. These include the associate from the American Association of Textile Chemists and Colorists who is assisting in the study of methods for testing fastness to light of dyed fabrics. Also the research man from the National Association of Hosiery and Underwear Manufacturers who is working on the standardization of twist with respect to dye application.

An increase in the expense account will likewise allow the broadening this next year of the Color Investigations of the Bureau of Chemistry of the U. S. Department of Agriculture. The allotment will permit the improvement and extension of the buildings at the Arlington Experiment Farm in Virginia to which have been transferred the Color Laboratory of the Chemistry Bureau. This is the institution which developed the method of making phthalic anhydride which has afforded a base for a whole series of vat dyes. The more recent work of the same laboratory, which is to be followed up by means of the increased facilities, consists in the development of a method for utilizing diphenyl instead of naphthalene for producing a compound which can be used as base for another series of dyes. The idea of the Government chemists, as our readers doubtless know, is to fortify the American dyestuffs industries with alternatives. In this instance the intent is to discount contingencies in order that, if the prices of naphthalene threatened to become prohibitive, a shift to diphenyl would permit the production of dyes satisfactory in replacement.

Not without promise for the dyestuffs industry is a new project of the Bureau of Chemistry consisting of a study of methods for the preservative treatment of fabrics. The department has collected statistics which show that, at the present time, this country is consuming annually for outdoor purposes more than $70,000,000 worth of cotton fabrics. The belief is that the use of cotton fabrics would be increased for outdoor purposes if means could be found for satisfactorily fireproofing, mildew-proofing and weather-proofing these fabrics without sacrifice of color values. This is the objective in the new research.

GEORGE EASTMAN AWARDED MEDAL OF AMERICAN INSTITUTE OF CHEMISTS

OFFICIAL announcement was made last night that the American Institute of Chemists had awarded its medal "for noteworthy and outstanding service to the science of chemistry and the profession of chemist in America" to Mr. George Eastman.

In making this announcement, Dr. Frederick E. Breithut, President of the Institute, referred to Mr. Eastman as "One of the greatest lay-scientists of the present day. Started as a small enterprise by an 'amateur photographer', as Mr. Eastman still calls himself, the growth and development of the Eastman Kodak Company is an industrial romance which shows the enormous possibilities of the intelligent application of chemical research to practical business.

"Mr. Eastman's research work toward simplifying and popularizing photography was begun in 1883 with his first attempts to make the now well-known roll film, and it was a chemical discovery—the use of nitro-cotton dissolved in the proper solvents—which marked the turning point of his career.

"One of the first buildings at Kodak Park was a chemical laboratory and throughout the entire development of his work, Mr. Eastman has always availed himself of the services of trained chemists, and whatever chemical

processes could in any way be useful to his projects. A research laboratory, one of the greatest in the country, was established in 1912 to deal specifically with the fundamentals of photography, and to carry on investigations along all lines of interest to the company. Its accomplishments, in chemistry and physics as well as in photography, were so effective that at present the Eastman Kodak Company is practically a self-contained chemical manufacturing concern. It operates plants for the manufacture of its own acids, silver salts, solvents, gelatine, large scale production of cellulose nitrate and acetate for all kinds of films, and a unique mill for photographic paper.

"The most noteworthy service to American chemistry in Mr. Eastman's career was made in 1918 when he approved the establishment by the Research Laboratory of a department of synthetic organic chemistry to manufacture and supply the various synthetic organic chemicals required for research purposes in the United States. The primary object of this much-needed move was to insure the complete independence of the United States in regard to these essential materials, and it received the co-operation and active support of both industrial and academic chemists throughout the country. Continued co-operation with all available sources of supply, and an active production program have increased the number of available chemicals to over 2,600—a number of high quality organic chemicals greater than that of any other country. The value of this work was recognized publicly when the Synthetic Organic Chemical Manufacturers Association, in 1925, made Mr. Eastman an honorary member.

"Mr. Eastman has always recognized the great value to him of the chemists of the country and of the institutions in which they were trained. His gifts to the Massachusetts Institute of Technology may perhaps be taken as a direct tribute to the chemists and engineers who came from there to assist him in the building up of his great business. In all, over sixty million dollars have been given by him to educational institutions, especially to the Massachusetts Institute and to the University of Rochester.

"The history of the Eastman Kodak Company shows what the application of chemical research can mean in the creation of new wealth in vast amounts. Many of our backward industries could profit by a study of Mr. Eastman's methods. Some of these industries do not yet comprehend what Mr. Eastman understood forty years ago. Mr. Eastman learned to apply chemistry to the control of the transformation of the materials which he used, and that knowledge has been applied by him, through the photographic science and art which is now a part of our daily life, to create not only wealth, but service and happiness for all mankind."

The California Silk Mills, Ltd., Sacramento, Cal., have been organized with J. M. Higgins as president, and W. O. Mills, secretary and treasurer. The new company plans to build a mill in Sacramento, it is reported.

Technical Notes

Dyebath, Studies in the; Dr. Friedrich C. Jacoby; Mell. Textil-Ber. 10, 121 (1929).—A paper from the Kaiser Wilhelm Institute of Berlin, relating to the effects of wetting-out agents in the dyebath. The introductory paragraph, giving a general idea of the paper, reads: "Beside the salts, which for a long time have played an important part in dyeing, assistants of an organic character, the so-called wetting-out agents, have of late come increasingly into use. It appeared to us to be of interest to investigate the physico-chemical influence of these agents upon solutions of dyestuffs, and incidentally upon the separate stages in the dyeing process. There were investigated three homogeneous, well-defined substances: Turkey Red oil, Tetracarnite (a mixture of homologous pyridine bases), and Nekal BX (the sodium salt of alkylated naphthol-sulphonic acids), as well as some mixtures (Oleocarnite, Neomerpin, Oranite, and Novocarnite), whose principal components consist of the substances mentioned. It became a question, during the investigation, of determining how chemically non-related substances, used for the same purpose, behaved in separate cases. For comparative purposes, an aqueous solution of dyestuff, without the addition of any wetting-out agent, was always used. As a representative of the direct dyestuffs Benzopurpurine 4B extra, already well known as to its physico-chemical behavior, was chosen."

Eight tables, covering solubility in 10% setting-out solutions at 80°, the double refraction of 0.3% Benzopurpurine 4B solution containing 0.3% of wetting-out agent, the per cent of dyestuff taken up at 50° and at 80°, and the values of luminosity of dyeings at 50° and at 80°, and also ten graphs, are given. The whole subject is being further investigated.

Bleaching (Acid and Alkaline Cold-Bleach). Dr. W. Kind and H. Korte; Mell. Textil-Ber. 10, 129 (1929).—The second part of a general paper upon the subject of bleaching. Four large tables and two graphs are included, giving results of various treatments with baths of varying composition.

Oxidizing Agents in Kier-Boiling, Effect of; J. Hausner; Mell. Textil-Ber. 10, 135 (1929).—A report upon and a discussion of a paper by Dr. Haller and Dr. Seidel, appearing in Zeit. f. angew. Chem., series 1928, p. 698. One table is given. The reviewer quotes the five conclusions reached by the two authors:

1. "Contrary to an earlier view, the addition of oxidizing agents in general is of distinct advantage. Aktivin is best suited for this purpose, on account of its neutral cleavage products, which are easily soluble and easily washed out. Compared with results from the older process, the whites are finer, without weakening of the fiber.

2. It is not unimportant as to what oxidizing agents are used. Those which easily give off their oxygen in alkaline baths are to be avoided.

3. Bleaching can be carried out at lower pressures when suitable oxidizing agents are added, since at lower pressures the oxidizing influence is prolonged.

4. The duration of the kier-boiling can be shortened, since in a shorter boil of four hours the same or a better result is obtained than by a normal (i. e., after the older method) one of from six to eight hours.

5. After use of the oxidative method, chloring can be carried out with more dilute hypochlorite solutions, which diminishes to a considerable extent the danger of tendering the fiber."

Oxycellulose, Contributions to Our Knowledge of; Dr. W. Haaga; Mell. Textil-Ber. 10, 137 (1929).—The first part of an exhaustive investigation of the effect of oxidizing agents upon cellulose, beginning with a study of the effect of $KMnO_4$ upon simpler substances whose behavior under attack might throw light upon the reactions of cellulose itself under similar conditions. Twelve tables are given. The subject will be further studied.

Chromate Yellow and Orange, Printing of, Upon Indigo Ground; "Tiba" 7,801 (1929).—(a) Sealed Note No. 1916, M. N. Wosnessensky—Soc. Ind. de Mulhouse—. Up to the present, only para red and alumina discharges have been printed upon indigo bottoms, except white discharges and aniline black. Recently there has been disclosed a good method for obtaining—nitro-o-anisidine red, by means of the nitrosamine, which is printed upon a fabric prepared with an organic acid. This method has been employed to produce certain other tones upon indigo, by the use of two nitrosamines, whose employment for that purpose has not yet been published. The swatches adjoined (to the original, of course) were prepared as follows:

Upon goods prepared in an ammonium acetate bath of 100 parts of acetic acid of 6° B. and 40 parts of 24% ammonia water per 1,000 parts, is printed a paste consisting of 80 parts of Nitrosamine J (= 16 parts of dichloraniline), 770 parts of a solution of chromate of sodium (= 100 parts of bichromate), thickened with dextrine-tragacanth, 50 parts of sodium aluminate solution of 10° B., 20 parts of pyrazolone, 35 parts of NaOH of 20° B., and 45 parts of water. (The nitrosamine J is prepared from 16 parts of dichloraniline, 40 of hot water, and 50 of HO1 of 19° B., cooling, adding 36 parts of ice, and 8 parts of sodium nitrite, and adding this diazo-solution slowly to a solution of 450 parts of NaOH solution of 38° B, and 150 parts of HC1 of 25%, cooled to zero.)

After a short steaming to develop the fullness of the tone, the goods are passed through a bath of sulphuric-oxalic acid, when yellow patterns on the indigo-blue ground are obtained. By printing on the same fabric with a paste containing the diazo-compound of dianisidine, an orange-red tone is obtained where this pattern overlaps the yellow pattern.

In this way, by means of the nitrosamines, we can obtain, besides the red of para-nitroaniline or p-nitro-o-anisidine, a yellow, either self or shaded with reddish-orange. The nitrosamine of chlor-anisidine gives, when applied in the same way, a bright orange. For this, the paste is made up from 860 parts of thickened sodium chromate, 100 of Nitrosamine O, 10 of beta-naphthol, and 30 of NaOH of 20° B., (Nitrosamine O is prepared by dissolving 20 parts of chlor-anisidine in 80 of water and 45 of HC1 of 19° B., adding 50 parts of ice, diazotizing with 12.5 parts of sodium nitrite, and pouring slowly into a mixture of 450 parts of NaOH of 38° B. and 150 parts of HC1 of 25%. This mixture is then warmed for about one hour.)

(b). Report upon the preceding by Pierre Binder (referee)—Sealed Note No. 1916 describes a process which, to tell the truth, does not constitute a new discovery, but rather a new application of a process already known. (Red discharges on indigo by application of a nitrosamine in presence of a chromate and naphtholate, and passage through an acid bath). The nitrosamine of p-nitro-o-anisidine is replaced by that of dichlor-aniline or chlor-anisidine, and the naphthol by the pyrazolone.

Cachou Chromate Discharge upon Indigo Ground; "Tiba" 7,803 (1929).—(a) Sealed Note No. 1917, M. N. Wosnessensky—Soc. Ind. de Mulhouse.—The number of dyestuffs which can be employed as discharges upon an indigo ground is considerably limited, since it is necessary that the color be very resistant to oxidation. To obtain a cachou tone, we start with nitroso-beta-naphthol, which gives with metallic mordants a series of shades very varied, and of good resistance to oxidation and to light. To prepare the swatch attached (to the original, of course), we print upon an unprepared piece of goods the following color: 200-400 parts of nitroso-beta-naphthol, 700-500 parts of a solution (thickened with dextrine) of 100 parts of sodium bichromate (neutralized), and 100 parts of nitro-acetate of chromium of 23° B. Cuts, 0/0, 1/0, 1/10. The printed goods are steamed for 2 minutes, and passed through a sulphuric-oxalic acid bath, as for ordinary indigo dyeings discharged with chromate.

(b). Report upon the preceding, by Pierre Binder (referee)—Sealed note No. 1917 is rather curious. The indigo is discharged by the same procedure as in the preceding, but in place of a nitrosamine and of an aromatic phenol the author employs nitroso-beta-naphthol in presence of a chrome mordant, or one of iron, or of cobalt. He thus obtains brown effects which are rather successful. The fabric, however, is tendered where printed. This is doubtless due to the steaming, which is necessary to fix the nitroso-naphthol to the mordant, but favoring at the same time an attacking of the fiber by the chromate. Since the discovery of the Indigosols, the problem of colored discharges upon indigo bottoms has been solved in a simpler and more satisfactory way. We can today attain varied effects either with vat dyestuffs, or with basic colors, or with diazotized bases.

Announcement has been made by Margaret Hayden Rorke, managing director, that the Textile Color Card Association is now sending out to members advance swatches of the fourteen colors which are to appear on the 1930 Summer Color Card.

These colors reflect the highlights of the Paris Summer openings, and stress as well other significant color developments forecast by the Association for the coming Spring and Summer seasons.

It was explained by Mrs. Rorke that these colors supplement but in no way lessen the importance of the 1930 Spring Season Card which portrays colors of high style importance, including blues in the range of Dulce Blue, Linen Blue, Lido Blue and Aquatone, pinks such as Cloud Pink, greens of the Wood-Nymph and Salad Green types, as well as other fashion-accepted colors like Sulphur, Gorge de Pigeon and Hacienda.

The colors appearing on the new card will be keyed to the Color Correlation Chart recently issued by the Association. Mrs. Rorke stated that the 1930 Summer Card would be issued very shortly.

Carbic Color & Chemical Co., Inc., have placed on the market two new Indigosols which they claim represent an especially valuable addition to their line of water soluble vat dyes in that they are much faster to light and chlorine than other types of Indigosols and, in addition, possess an excellent all round fastness. These products are Indigosol Brown IRRD and Indigosol Scarlet IB. These two new products are described in attractive pamphlets issued to the trade recently.

The American Aniline Products, Inc., has recently issued a shade card entitled "Amanil Colors on Bleached Cotton Cloth."

This book includes methods for dyeing, dissolving, diazotizing and developing amanil colors, a complete index of fastness to washing, to light, and to acid.

It also describes the amanil colors leaving silk effects white and leaving acetate silk effects white.

In addition to showing a complete table of how these amanil colors are effected by iron, copper and Monel method, a complete set of amanil developed colors is included and a table showing the dischargeability of the products above mentioned.

The National Aniline & Chemical Co., Inc., have announced a new addition to their direct dyes, National Solantine Violet FFR. They maintain that it produces on cotton or rayon of the regenerated types bright violet shades, of a reddish tone, possessing a very good fastness to light. Because of its good solubility and level-dyeing property, the company states, this new dye can be used satisfactorily in all types of circulating machines, as well as in the dyeing of piece goods. A bulletin has been issued containing complete information about this new product.

John Campbell & Co. have reported to the trade that they are now manufacturing Amidine Catechine 3G which may be used in considerable quantities for the dyeing of cotton and rayon. They recommend it on account of its good solubility, slow and even dyeing properties and for its excellent exhausting qualities.

They have also produced Amidine Brilliant Pink 8B which is said to be a level dyeing, direct pink, having extraordinary good fastness, excellent properties to rubbing, ironing, fastness to alkali and to organic acids. Its closest pre-war identity resembles the Dianol Pinks of Levenstein, according to the announcement.

General Dyestuff Corporation has brought out circulars illustrating Rapid Fast Scarlet L H and Variamine Blue Salt B. The former is recommended as something very new in the line of "H" types which are recommended because of the good stability of their printing pastes.

The rate for "Position Wanted" advertisements in this column is 2 cents a word—with a minimum of 50 cents per insertion. For all other types of advertisements—i.e., help wanted, machinery or supplies for sale—the rate is $5.00 per column inch or less per insertion.

COTTON AND RAYON DYER

Position wanted by cotton and rayon dyer; 19 years' experience dyeing warps, skeins and mercerized yarns, with napthol, indanthrene, sulphur, developed, direct and basic dyes. Best of references. Address Classified Box No. 587, American Dyestuff Reporter, 440 Fourth Ave., New York City.

CHEMIST

Chemist with years of experience in manufacturing and research on sulphonated oil and chemical specialties desires position. Reply to Classified Box No. 590, American Dyestuff Reporter, 440 Fourth Ave., New York, N. Y.

HOSIERY DYER

Hosiery Dyer desires a position with hosiery manufacturer or a concern dyeing hosiery. Address: Classified Box No. 591, American Dyestuff Reporter, 440 Fourth Avenue, New York, N. Y.

WANTED

A man with following in textile trade, accustomed to the selling and application of products for silk, rayon and cotton, to act as sales representative. Apply giving experience, qualifications, basis remuneration. Address Classified Box No. 592, American Dyestuff Reporter, 440 Fourth Ave., New York, N. Y.